Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

OCTOBER ★ 1953

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 109—Journal Section of The American Society of Heating and Ventilating Engineers

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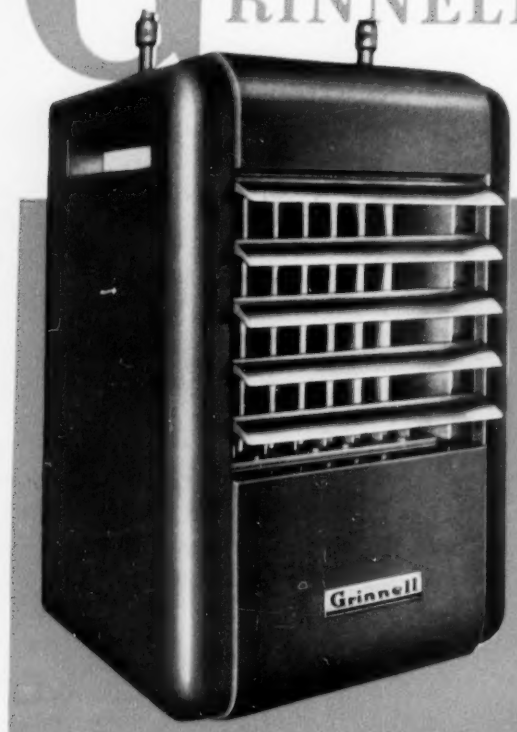
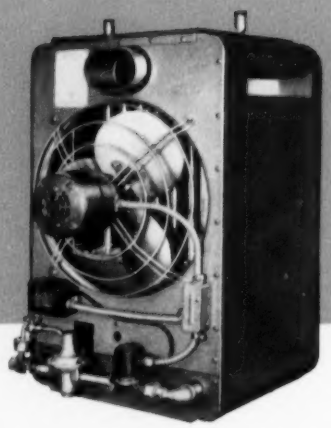
HOW TEMPERATURE AFFECTS EFFICIENCY 80

GRINNELL announces its new line of

GAS-FIRED UNIT HEATERS



Available in 7 sizes — with input ratings from 25,000 to 200,000 Btu's.



All parts readily accessible for periodic servicing.

AUTOMATIC! EFFICIENT! ASSURE YEARS OF DEPENDABLE SERVICE

Grinnell gas-fired unit heaters are easy to install, simple to operate and maintain. Efficient performance assured — with any type of gas — by modern design of burners and heat exchanger, proper motor and fan unit.

Automatic safety pilot operates to shut off main gas supply if pilot burner goes out. Flashback and extinction noise prevented by the burners' raised port design and proper port size for the gas used. Low speed motors have built-in thermal overload protection and automatic reset.

Additional features of Grinnell *gas-fired* unit heaters . . .

- Casing die-formed of heavy steel, with baked-on enamel finish
- Heat exchanger tubes and draft diverter of aluminized steel
- Combustion chamber of heavy steel, welded
- Burners of close-grained iron castings
- Adjustable louvers
- Burners and control assembly removable as a unit
- Hinged bottom pan permits cleaning interior of tubes
- Threaded pipe hangers for easy suspension
- Only wiring required is connection to room thermostat or manual switch
- Approved by the American Gas Association

WRITE FOR CATALOG

GRINNELL
UNIT HEATERS FOR STEAM, HOT WATER, GAS

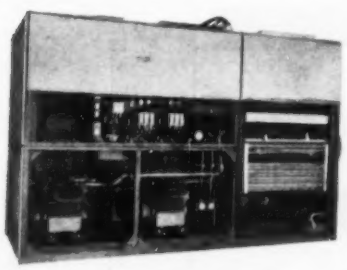
Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports
Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

Dual-Circuit Air Conditioning Economy Proved at Tahiti Apartment Motel

Miami Beach installation cools 62 rooms, lobby and coffee shop with single package unit

ONE USAIRCO 50 H.P. DRK comfortably cools the 62 rooms of the Tahiti, plus this modern motel's lobby and coffee shop. The Dual-Circuit Refrigerated Kooler-aire completely processes and conditions air within a single "packaged" unit. Air conditioner, compressor and evaporative condenser sections are combined in this one assembly, with two complete refrigeration circuits.



Architect Norman M. Giller, had more than cool comfort in mind when he chose USAIRCO's DRK for the Tahiti. Since definite limitations on starting current are in effect in this Miami Beach area, he looked for an air conditioning plant that could meet the problem. The answer was this USAIRCO unit because DRK's starting current requirements are only ½ of normal, due to the time delay relay. There is no need for reduced voltage starters.

Seasonal variation requires definite capacity controls. Again, the USAIRCO DRK proved the answer. It is wired with a two-stage thermostat, which automatically puts into operation one or both compressors, depending on load requirements. When operating at reduced capacity, separate refrigeration circuits provide effective dehumidification.

All rooms in the Tahiti face outside and have manually adjustable register controls. Supply and return duct system is connected to the DRK located in the center of the building.

Each DRK unit is custom fabricated at the factory. Available in 7 sizes, from 10 to 50 H. P.

See your nearest USAIRCO agent or write to Dept. HP 103

UNITED STATES
AIR CONDITIONING CORP.
3300 Como Ave. S.E.
Minneapolis 14, Minn.

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General Contr.: San Ford Kay Construction Co.
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The pipe that lasts the longest costs the least.

"Which piping material will last the longest?"—that's the big question which faces everyone who has the say-so on piping for corrosive services. To find the *right* answer—essential in these days of rising maintenance and replacement charges—more and more cost-conscious planners are turning to *past service records* for their yardstick to selection.

How successfully Byers Wrought Iron pipe "measures up" when engineers and architects go after this how-long-does-it-last story is reflected in the increasing use of the material in every aspect of today's modern building.

Small wonder for this confidence!

Take these eight Dallas Buildings, for example. In each installation, wrought iron pipe is providing long life service at lower cost per year. And designers everywhere are finding similar wrought iron performance records.

If you are in doubt about pipe for some corrosive service, we'll be happy to show you past wrought iron service records to fit your particular problem. Just address your letter to our Engineering Service Department . . . your request will be handled promptly.

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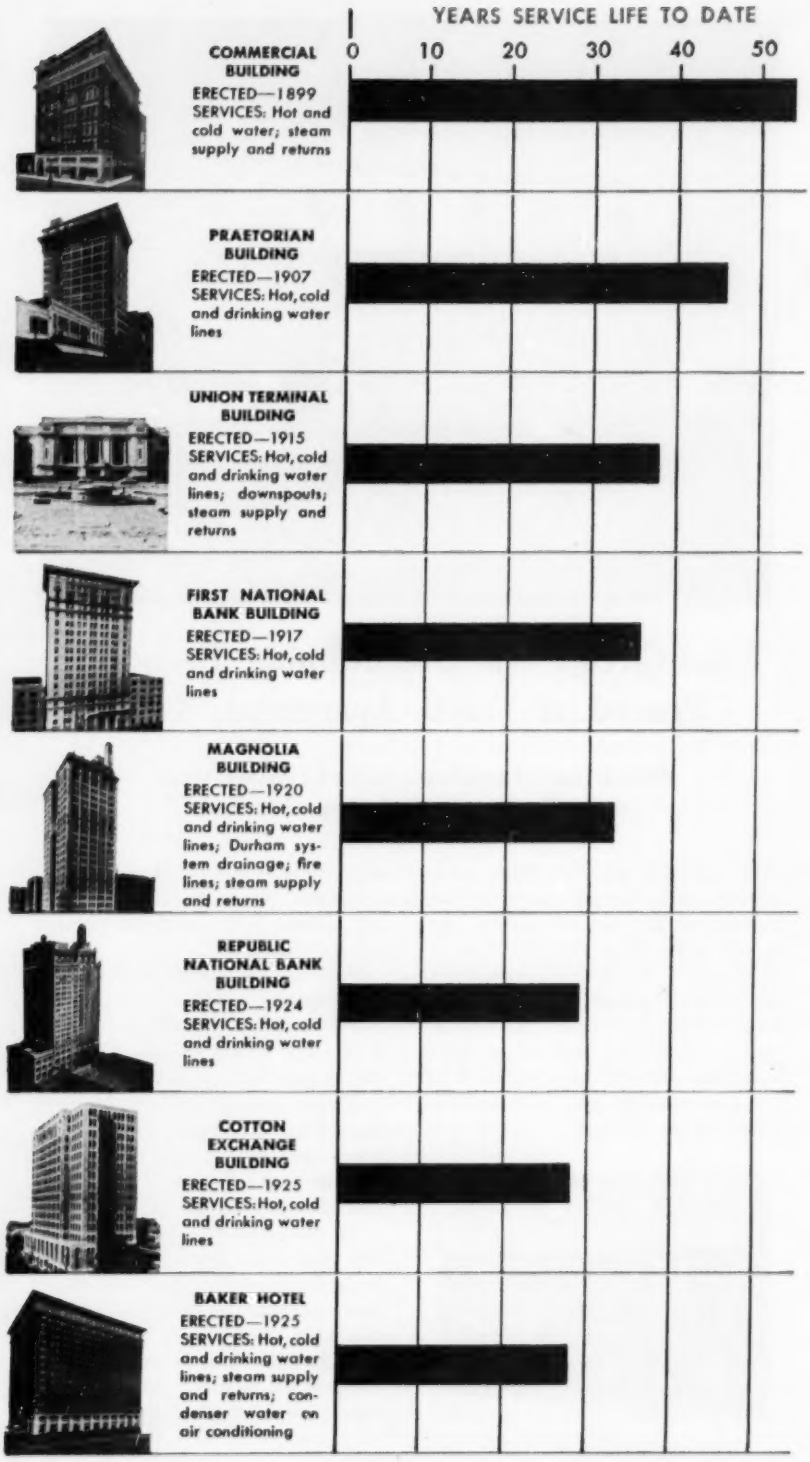

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CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Heating Piping & Air Conditioning

Vol. 25 No. 10

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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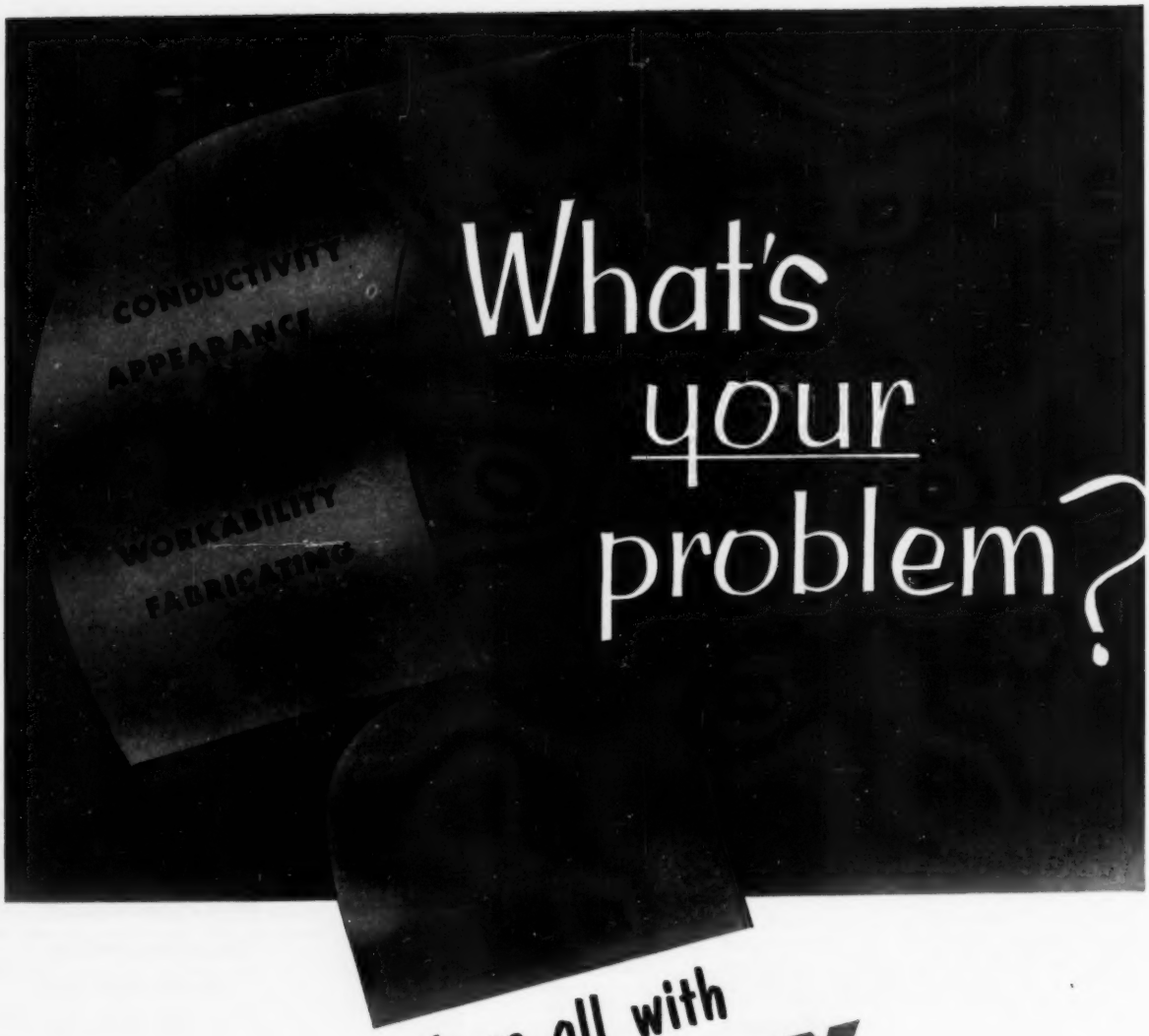

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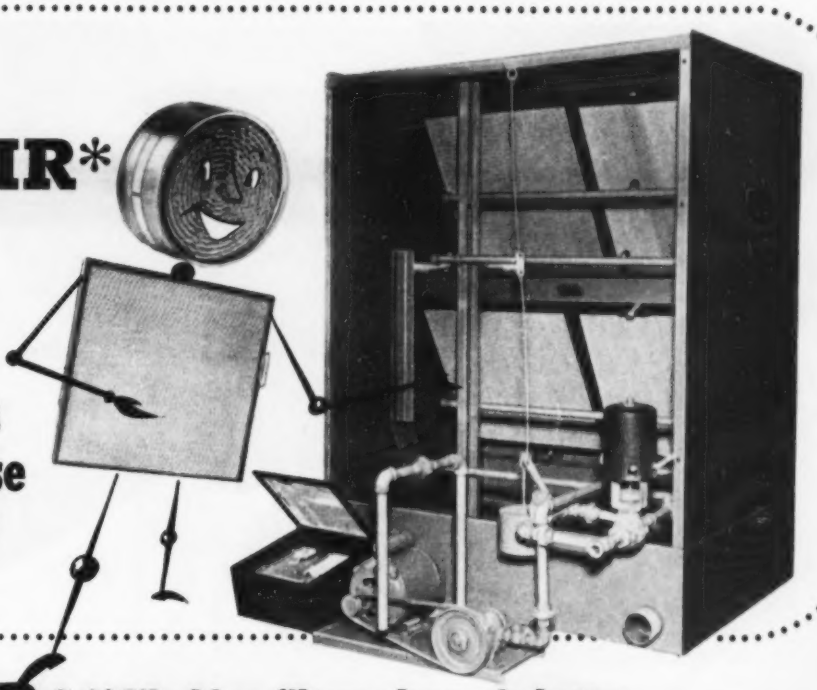
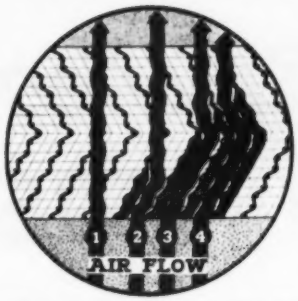
only FAR-AIR* gives you completely automatic air filtration with all these advantages!



FAR-AIR Self-Washing filters clean air better . . . provide these automatic features, too!



FAR-AIR Self-Washing filters give you more efficient, more dependable service. That's because FAR-AIR's exclusive herring-bone-crimp media design permits progressive loading and free air flow.

Find out today about completely *automatic* air filtration.

Washing, drying and oiling is controlled electrically on a pre-determined time schedule . . . *automatically!* Air cleaning efficiency remains constant. There is no liquid particle entrainment.

Water and dirt are flushed directly to sewer . . . *automatically!* There is no messy oil sump to collect sludge and create a fire hazard. Maintenance man-hours are reduced. Built-in controls guard against fire . . . *automatically!* These are Far-Air features:

No entrainment • No sludge—no oil sump
Automatic fire control • Minimum maintenance
Easy installation

FAR-AIR FILTERS

"Better by Farr"

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Please send me information on FAR-AIR Self-Washing filters.

I would ☐ would not ☐ like a Farr Field Engineer to discuss my air filtration problem with me.

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Company _____

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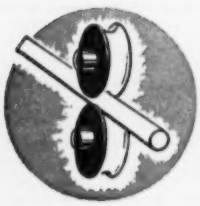
Get to know your Republic Steel Pipe Distributor. He stocks high quality materials to give you profitable service.



Easy to bend, thread, and close coil
Easy to weld by all methods
Uniformly ductile
Uniformly strong
Uniformly clean and scale-free
Uniform wall thickness, diameter, concentricity
Economical uniform lengths, extra long lengths

REPUBLIC STEEL

Republic STEEL PIPE

MOTORIZED CHIMNEY DRAFT

with the WING DRAFT INDUCER

No boiler can operate satisfactorily or efficiently over wide ranges of weather or load with variable natural draft. The fuel—whether oil, gas or coal—must have enough oxygen for complete combustion. There must be sufficient draft or furnace fires will be slow burning and lifeless, resulting in uneven, insufficient and irregular heat.

WING Draft Inducers insure positive, adequate, uniform draft regardless of variable weather conditions or inadequate chimney or breeching construction.

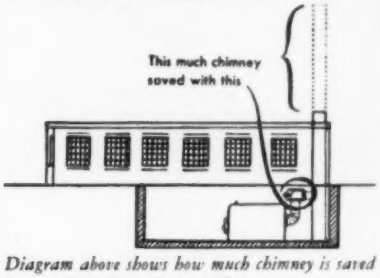


Diagram above shows how much chimney is saved by installing Wing Draft Inducers.

Wing Draft Inducers are suitable for use in connection with oil, gas, stoker-fired or hand-fired heating boilers, industrial furnaces or kilns, or high pressure steam boilers, either stationary or marine. Sizes are available for boilers as low as 1000 sq. ft. E. D. R. up to steam generators producing 100,000 pounds of steam/hr. Special, heavy duty designs available for these larger boilers.

Wing Draft Inducers are made in two types—for insertion in breeching or flue, or for installation on top of a chimney. Write for a copy of Bulletin I-52 to L. J. Wing Mfg. Co., 140 Vreeland Mills Road, Linden, New Jersey.

Install WING Revolving Unit Heaters

An outstanding and exclusive feature of WING Revolving Unit Heaters is the revolving air distributor having one or more outlets.

As the distributor slowly turns, heated air is delivered from each outlet obliquely downward, in ever changing directions, to the working floor.

USERS SAY:
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"Air circulation below, around and above planes."
"No hot spots on planes or parts."
"Quick heat recovery after closing doors."
"Expedites servicing by melting ice and snow quickly."

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AIR CONDITIONING CONTRACTORS LIKE Allis-Chalmers complete drives because they can save money and still assure the customer of a top quality job without service problems. Allis-Chalmers District Office representatives understand the problems of air conditioning contractors and offer them help in engineering exactly the right drive for the application. Since all parts of the Allis-Chalmers drive are of coordinated design and manufacture, they match up and fit together quickly and easily. And buying from a single source is less trouble . . . means that all components arrive on the job together, ready to be installed.

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Nearly every industrial area in the country has one or more Allis-Chalmers Certified Service Shops . . . independent service shops which meet Allis-Chalmers high standards for modern equipment, efficient methods and business integrity. These shops assure your customer of factory-approved parts and service.

For lower engineering and installation cost . . . for one reliable guarantee of satisfaction on the complete drive unit . . . for quick delivery and top notch service . . . make your next drive Allis-Chalmers.

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- ☐ Squirrel-Cage Motors 51B6210

Control
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***Texrope* Drives**
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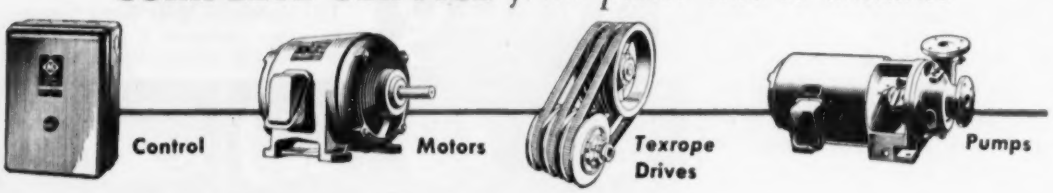
- ☐ *Vari-Pitch* Drive Engineering Data 20B7499

Allis-Chalmers, Milwaukee 1, Wisconsin

COMPLETE SERVICE *from power line to machine*



Drive Problems

ALLIS-CHALMERS
COMPLETE
DRIVES
Motor Control
Allis-Chalmers motor control is available for most air conditioning applications from Size 0 up. Allis-Chalmers builds many types of variable speed control for ac and dc wound rotor motors. These are applied to pumps, fans and other machines requiring speed control.
Motors
Allis-Chalmers general purpose and special motors meet almost any air conditioning need from ½ hp up. Types include squirrel cage, wound rotor and dc for single or multi-speed operation. These motors are available with a full range of torque characteristics and a wide choice of enclosures and mounting methods. Many air conditioning contractors are now recommending Allis-Chalmers fin-type totally-enclosed, fan-cooled motors because of their extremely low maintenance costs. Protected from dirt and moisture, these motors last longer and require less service than standard open types.
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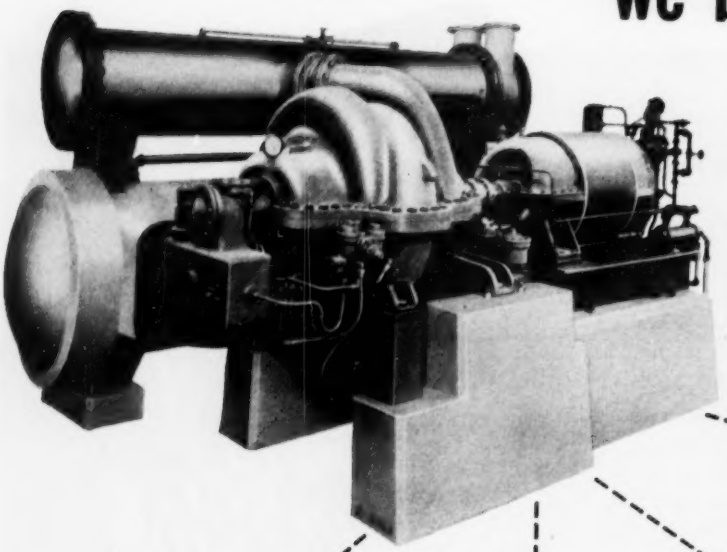
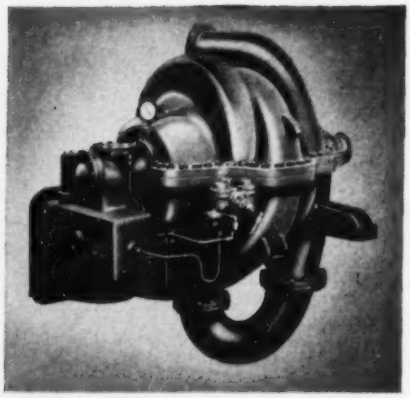
A-6010

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

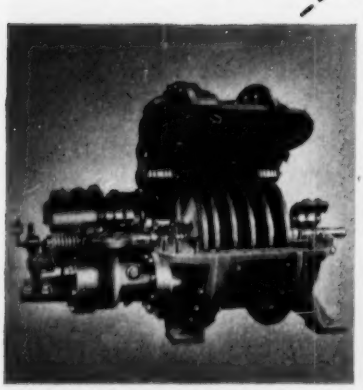
ALLIS-CHALMERS

We know it'll do a job for you . . . we built all of it!

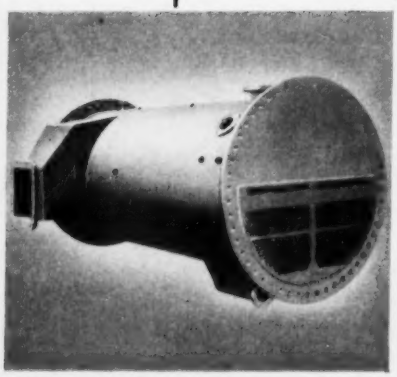




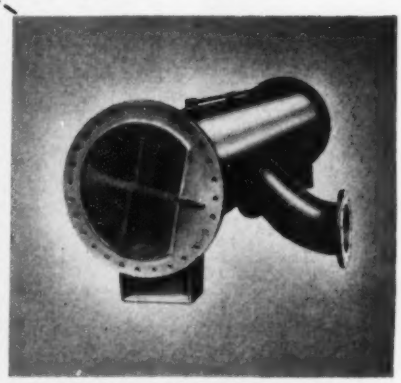
INCREASED EFFICIENCY results from volute design of the Worthington centrifugal compressor. Smooth, obstruction-free passage for gas reduces friction and turbulence losses.



TYPICAL WORTHINGTON MULTI-STAGE steam turbine, ideally suited for compressor-drive applications.



OVERALL SAVING in power consumption is made possible by the flash pre-cooling chamber in the Worthington cooler.



WORTHINGTON CONDENSERS are of the horizontal shell-and-tube type, with water inside the tubes and refrigerant gas outside.

Every major component in a Worthington centrifugal refrigeration system is designed, engineered and built at the Worthington plant. Worthington, for example, is the only manufacturer that builds drives as well as compressors.

This is one big reason why leaders in industry are turning more and more to Worthington centrifugal refrigeration systems. Present-day installations include CBS Television City; the new Alcoa Building, Pittsburgh; Saks Fifth Avenue; the Hotel Commodore, and the General Petroleum Building in Los Angeles.

Worthington also makes condensers, coolers and auxiliary equipment such as steam condensers, condensate pumps, steam jet air ejectors and step-up gear sets. Write for free Centrifugal Refrigeration Bulletin C-1100-B14 to Worthington Corporation, Air Conditioning and Refrigeration Division, Harrison, New Jersey. A.3.41

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

TRI-FLEX and AEROVANE REGISTERS

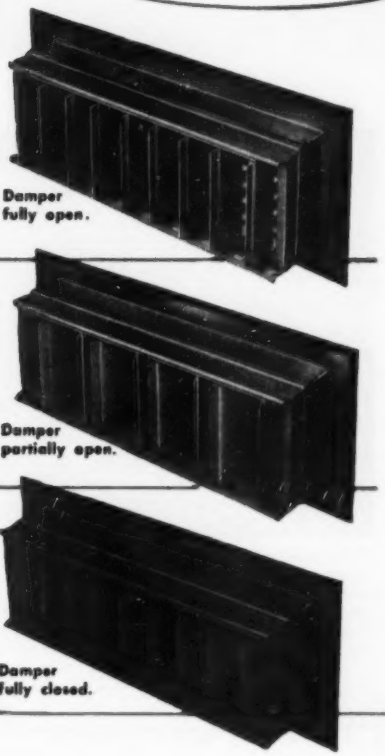
equipped with

Opposed Blade Dampers

Showing TRI-FLEX T-647 Double Deflection Register with Opposed Blade Damper

KEY OPERATOR FOR OPPOSED BLADE DAMPER

Blades are regulated by key operator which may be removed or tapped permanently into place.



Damper fully open.

Damper partially open.

Damper fully closed.

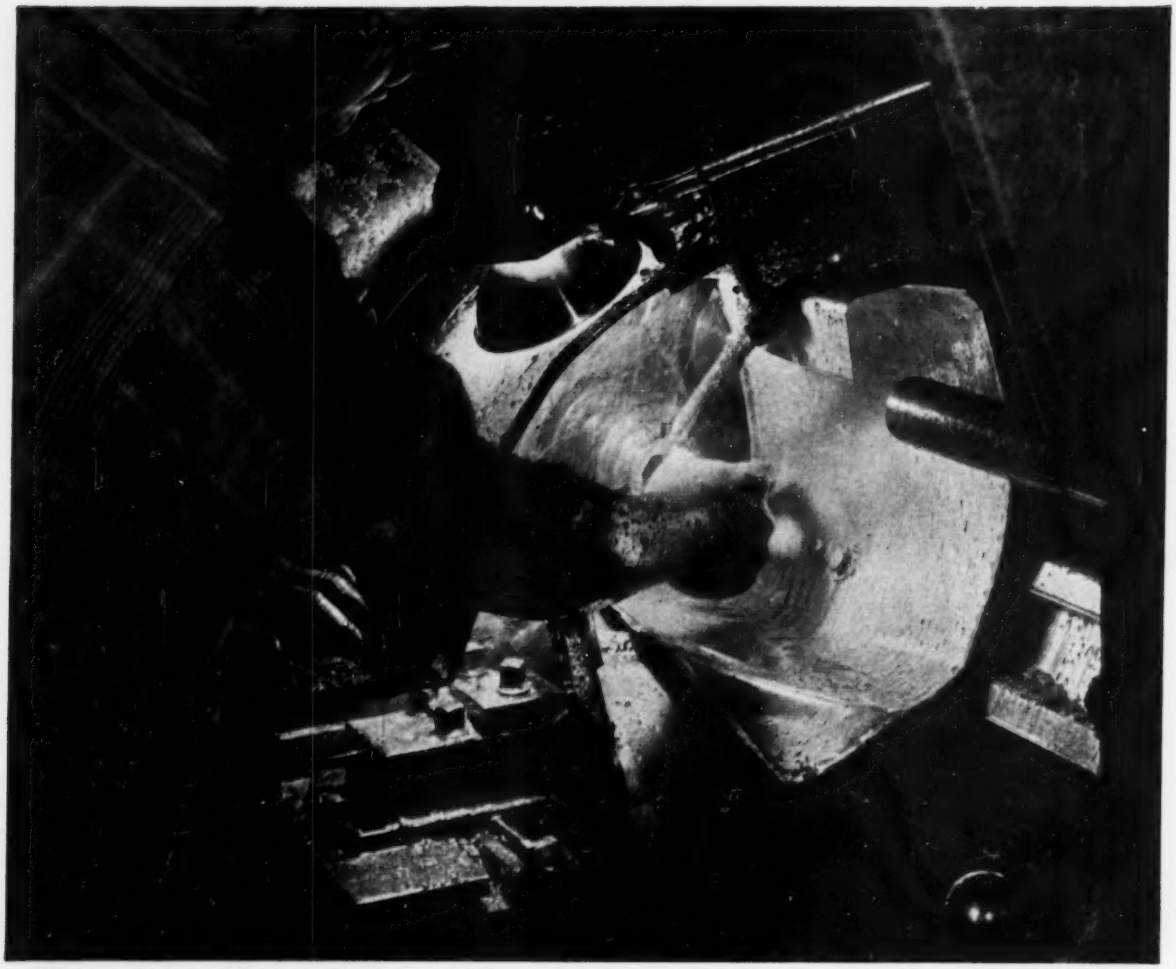
TRI-FLEX Supply Air Registers and AEROVANE Return Air Registers — specified and installed on important air conditioning jobs — are now constructed with opposed blade dampers.

This improved damper unit insures uniform distribution of air over the entire face of the register . . . and provides positive damper setting in any position from fully open to fully closed regardless of system pressure. Set in a rigid steel frame, blades are formed for extra strength and stiffness, and overlap when closed, eliminating any possibility of air leakage. Blades are regulated through the face of the register by means of a key operator which may be removed or tapped permanently into place.

For complete information and size selection data for TRI-FLEX and AEROVANE Registers and Grilles, write for a copy of Catalog No. 200.

TUTTLE & BAILEY inc

NEW BRITAIN, CONNECTICUT



Workers no longer breathe oil mist.

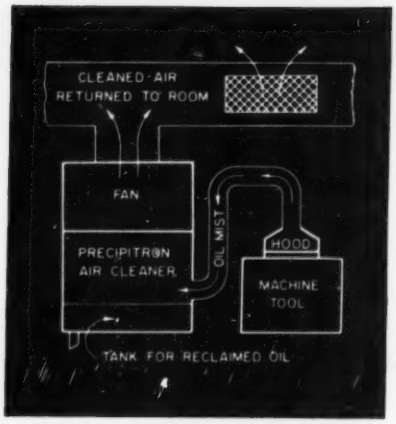
ELECTRONIC TRAP

SNARES OIL MIST, UPS EFFICIENCY

Whirling chucking machines throw up clouds of vaporized oil coolant. At Scovill Manufacturing Co., this formerly restricted visibility, reduced operating efficiency, caused hazardous working conditions. Oil mist on wiring threatened fire, too.

But Westinghouse PRECIPITRON® Oil Mist Control wiped out this problem. This unique device snares the oil out of the air by electronic attraction; allows only pure air to pass. It provides these benefits: 1) salvaged coolant oil; 2) improved working conditions; 3) safety from slippery floors and tools.

Westinghouse will *put air to work* to save you money, too. Our full line of air cleaning, air conditioning and air handling equipment solves many production problems. Call your local Westinghouse-Sturtevant office, or write Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

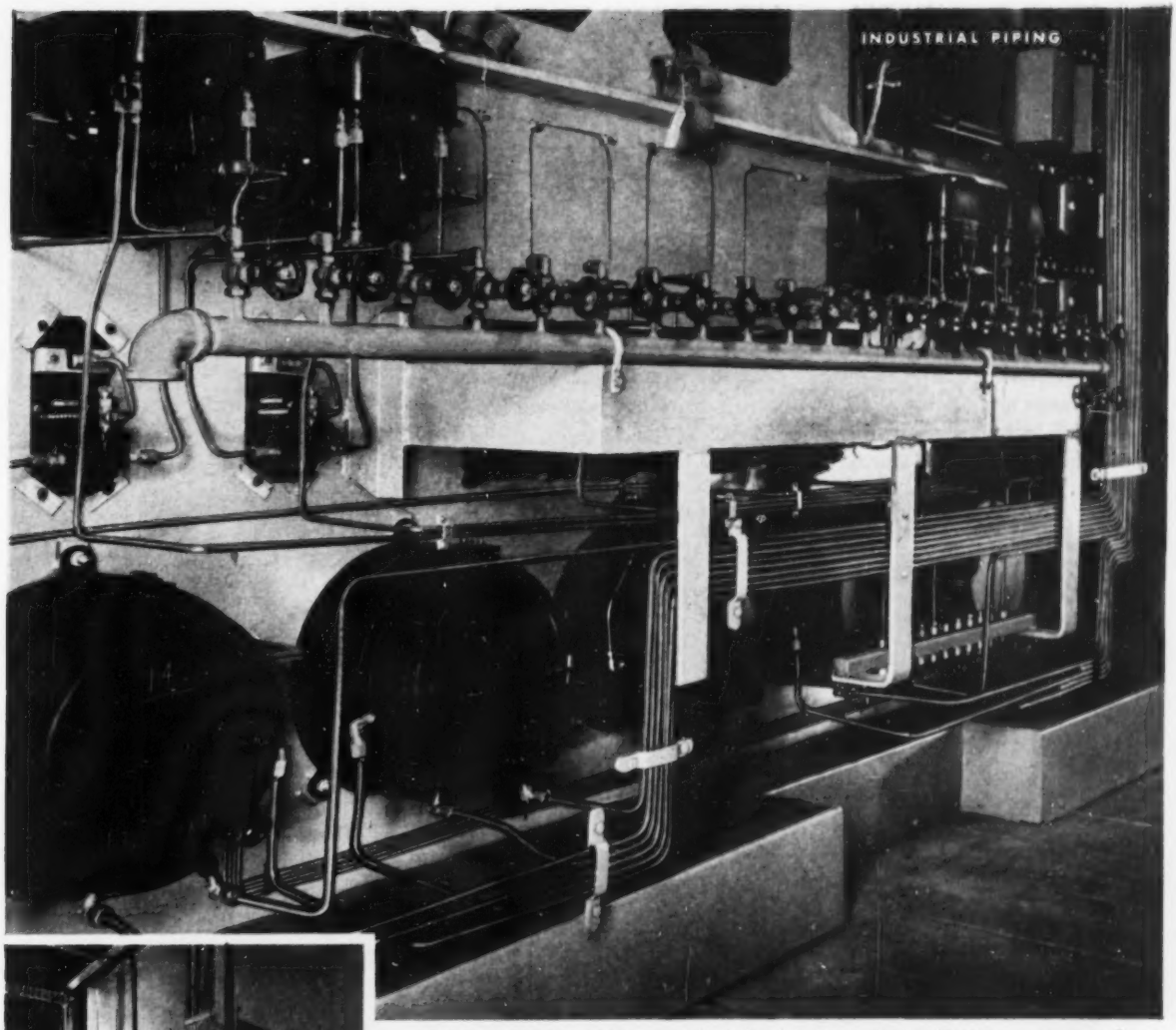


Collection hoods catch oil mist at its source. Quiet, efficient Westinghouse fan units draw coolant-laden air through PRECIPITRON air cleaners. PRECIPITRON traps smoke, fume and fog particles. It costs only pennies per week to operate, has no moving parts to wear out or replace.

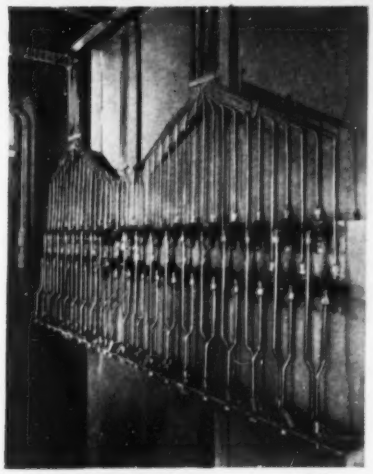
WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE... IF IT'S **Westinghouse**

J-80330



THESE AIR SIGNAL LINES in Toronto's Richard L. Hearn Power Station use copper tube in long lengths, change direction and avoid obstructions without fittings.



MOIST COMPRESSOR AIR can never form rust or scale to impede control in this installation made by Bailey Meter Co., Ltd.

Wet air can't rust this copper control piping

CONTROL would be impaired if moisture could create rust or scale in these pneumatic control lines for coal-pulverizing equipment installed by Bailey Meter Company, Limited, in Toronto's Richard L. Hearn Power Station. A number of these copper tubes convey differential pressures to the pulverizer feeder controllers, while others transmit an air signal to the pulverizers to selectively limit the rate of coal feed. Rust particles which might interfere with the satisfactory operation of the control system cannot form, and the smooth bore keeps flow resistance at a minimum.

Here, as in all copper tube systems, the long lengths, the light weight and the elimination of many fittings by bending all make important savings in installation costs. Where flare or solder-type fittings are used, there are no threads to cut, and connections stay tight.

Publication C-24 offers many additional facts on how ANACONDA Copper Tubes can help improve product quality, reduce operating and maintenance costs and avoid costly shutdowns. Write to: *The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.* 5330

call your

ANACONDA®

distributor for

Copper tubes and fittings for industrial process lines, water, heating and sanitary drainage systems; American Flexible Metal Hose and Tubing; American Vibration Eliminators.

*A **quick** source of reliable*

Air Conditioning and Refrigeration Pumps

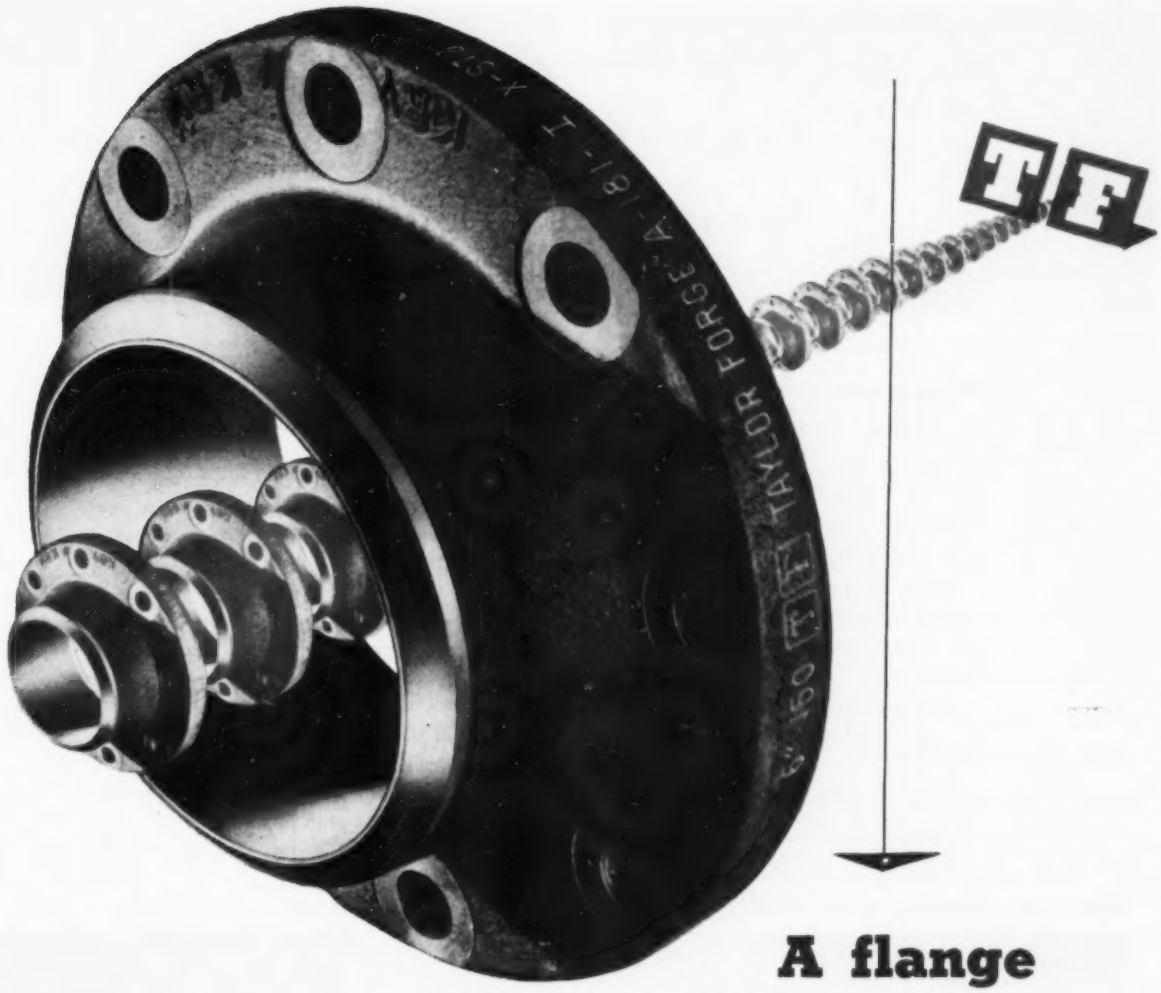
For circulating water through cooling towers and evaporative coolers, Marlow offers a wide range of exceptionally dependable pumps designed specifically for this service. Although ruggedly constructed, these pumps are compact and easily installed in cramped quarters, in any position, at any angle. Over a quarter century's specialized pump experience insures peak performance and longest service life. Marlow Pumps are quickly available in quantity from stocks placed at strategic locations across the country. Ask for complete details about these sturdy, compact, and highly efficient pumps.

World's largest manufacturer of self-priming centrifugal, diaphragm and plunger pumps . . .

Marlow Pumps

Ridgewood, New Jersey • Branch Plant — De Queen, Arkansas

Other factories in France and England. Distributors and dealers everywhere.



A flange with a background . . .

You are looking at a flange with a history. Taylor Forge made the forged steel flange and in a sense the forged steel flange made Taylor Forge. It was Taylor Forge, back in 1905, who made the first forged steel flanges on a commercial scale . . . and it is Taylor Forge who has guided flange development across the past half century.

Through the first threaded flange form, the bolted Van Stone form, and the perfected welding neck form pictured here, Taylor Forge has undeniably contributed more to flange development than any other organization*.

Taylor Forge Welding Neck Flanges are a part of the WeldELL® line—the line that more than 20 years ago gave industry the first complete line of fittings for pipe welding. The organization that led development is still leading . . . in scope of types, sizes, weights, materials . . . in quality and downright value!

For up-to-the-minute facts see your Taylor Forge Distributor

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS, General Offices & Works: P.O. Box 485, Chicago 90

Plants at: Carnegie, Pa., Fontana, Calif., Gary, Ind., Hamilton, Ont., Canada

When pressures rose from the old 150- and 300-pound standards to 400, 600 and finally 900 pounds, it was largely the exhaustive research of Taylor Forge that supplied the formulas for determining stresses in flanges for any given condition of loading. Among many examples: the Taylor-Waters formula, published in 1927, became and still is the basis of recognized practice for flanges in sizes through 24". Again, in 1938 Taylor Forge published the first edition of the now authoritative "Modern Flange Design" based on methods proposed by E. O. Waters, D. B. Rossheim, D. B. Wesstrom and F. S. G. Williams, Taylor Forge Manager of Engineering Standards. (ASME Trans., Apr. 1937)

How Honeywell Customized

Temperature Control can help you

Give your clients the control they need

Why a customized control system is becoming a "must" for all types of buildings

It's as true for any kind of building—of any size—as it is for a motel:

It's important to recognize the value of *proper* temperature control.

Here's what's needed to give your clients proper control—resulting in genuinely modern comfort or new industrial efficiency, or both:

Enough controls of the *right* kind, *properly* installed—and backed by a dependable service organization.

That's a taller order than a lot of people seem to think. And it's just the spot to call on Honeywell Customized Temperature Control.

The key word here is "customized." This means that whatever your clients' control requirements, a Honeywell Customized Temperature Control System *designed to their needs* is your answer. This applies to heating and cooling, ventilation and humidity control, as well as industrial control.

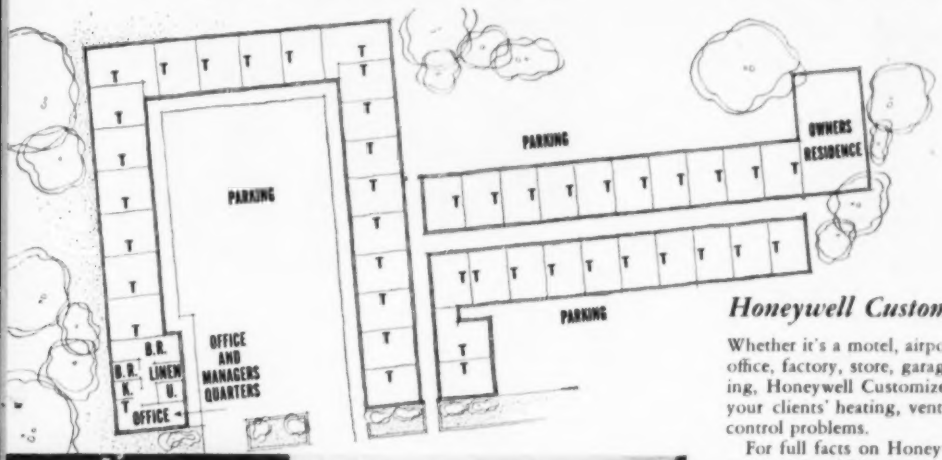
The story, in brief, of how Honeywell Customized Temperature Control was used to solve specific occupancy, use and exposure problems in the Oregon Motel in Eugene, Oregon, is told under the pictures at right.

The *techniques* used, applied to your clients' particular problems, could readily be the solution to their problems.

Customer-eye-view of the Oregon Motel, located on the outskirts of Eugene, Oregon. Every guest room of the motel is equipped with a Honeywell thermostat.

Every guest room in the Oregon Motel is equipped with its own thermostat, as indicated by the T's on the floor plan below. The main reason this was done was to give guests personal control over their own comfort—a big factor in the motel business. For as the motel business becomes more competitive, guests can and do demand even greater comfort. This problem can be met, easily and completely, by installing Honeywell Customized Temperature Control.

Other important problems solved with a separate Honeywell thermostat and radiator valve in each room include exposure and occupancy factors. Rooms on the south receive more winter sunshine, require less heat than rooms on the north. Individual thermostats easily meet this problem by calling for just the right amount of heat on an *individual* room basis. And when rooms are unoccupied, temperatures may be cut back to save fuel.



For comfortable, even temperature in new or existing buildings—of any size—use

Honeywell Customized Temperature Control

Whether it's a motel, airport, hospital, apartment, church, school, office, factory, store, garage—or any size building—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. There are 104 Honeywell offices across the nation. Or mail the coupon today.

Walter Dennis, owner of the Oregon Motel, says:

"Since installing Honeywell Customized Temperature Control, fuel bills have been 40% lower and occupancy has increased 9%. It's not hard to see why I like the installation. I like concrete results—and that's just what I got."

MINNEAPOLIS **Honeywell**

H HONEYWELL First in Controls

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HA 10-203, Minneapolis 8, Minnesota

Gentlemen:

I'm interested in learning more about Honeywell Customized Temperature Control.

Name .....

Firm Name .....

Address .....

City ..... *Zone* ..... *State* .....

Peerless Design - Easy Installation - Trouble-Free Performance Build Profits!

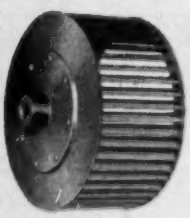
DIRECT DRIVE BLOWER

Powered by premium-built, job-matched Peerless motors from 1/6 to 2 HP for general exhaust and ventilation where large volumes of air at economical cost is important. Housing can be set in eight different positions for discharge at any angle. Each unit registered and guaranteed.

BELT DRIVE UTILITY BLOWER

Matched with Peerless Electric Motor. From 1/6 to 7-1/2 HP. Housings are convertible. Blowers for counterclockwise rotation furnished as specified. Arc-welded frames and housings. All units have Peerless registration and guarantee.

Wheels 18" in diameter and larger are welded. Sizes 27" have three tie-rods for extra rigidity. Wheels dynamically balanced.



On blowers 15" in diameter and smaller . . . riveted construction . . . dynamically balanced . . . vibration-free operation at high speeds.

This is the season that calls for complete, easy-to-install Peerless Utility Blowers for clearing smoke, fumes or stale, humid air quickly and economically.

They put bigger fall and winter profits in your pocket because there are less call-backs and easier installations. Peerless design gives these blowers smooth-running efficiency and long life. They are finished in hard-baked green enamel . . . housings quickly adjustable for proper angle of discharge . . . the entire unit, including job-matched motor is designed, manufactured and assembled under one roof!

Peerless Utility Blowers take less time to install, and where a question of size or motor speed arises, the Peerless Engineers will give you a hand in choosing the blower best suited for the job.

Peerless blowers give you trouble-free performance that eliminates costly call-backs. Rugged arc-welded frames and housings . . . Peerless Premium-Built Motors . . . and a unit that is built by one manufacturer make servicing simple when it's necessary. Add to these features the Peerless Guarantee and the Peerless Registration and you have Peerless Blowers . . . "the smoothest performers on the market." When you install or specify a blower, be sure it's a Peerless. It's a sure ticket to customer satisfaction and bigger profits.

"SMOOTHEST PERFORMERS ON THE MARKET"

FAN AND BLOWER DIVISION

THE PEERLESS ELECTRIC COMPANY

1607 WEST MARKET ST. - WARREN, OHIO

Peerless Electric

WHY IT PAYS TO BUY STEEL FROM WAREHOUSE

You don't waste productive space storing steel!

WHEN YOU BUY STEEL FROM WAREHOUSE, YOU GET:

- LOWER INVENTORY COSTS
- LOWER SPACE COSTS
- LOWER TIME COSTS
- LOWER CAPITAL INVESTMENT
- FASTER PRODUCTION
- FEWER INVENTORY LOSSES

You can turn your present steel storage space into profitable production space—without danger to the continuity of your steel supply. Just use a U. S. Steel Supply warehouse as your own. U. S. Steel Supply can deliver the steel you want to your plant or job site at whatever time you desire. Ask your U. S. Steel Supply salesman to arrange delivery of your steel at *your* convenience—and you'll find your steel arriving with timetable dependability.

U. S. STEEL SUPPLY

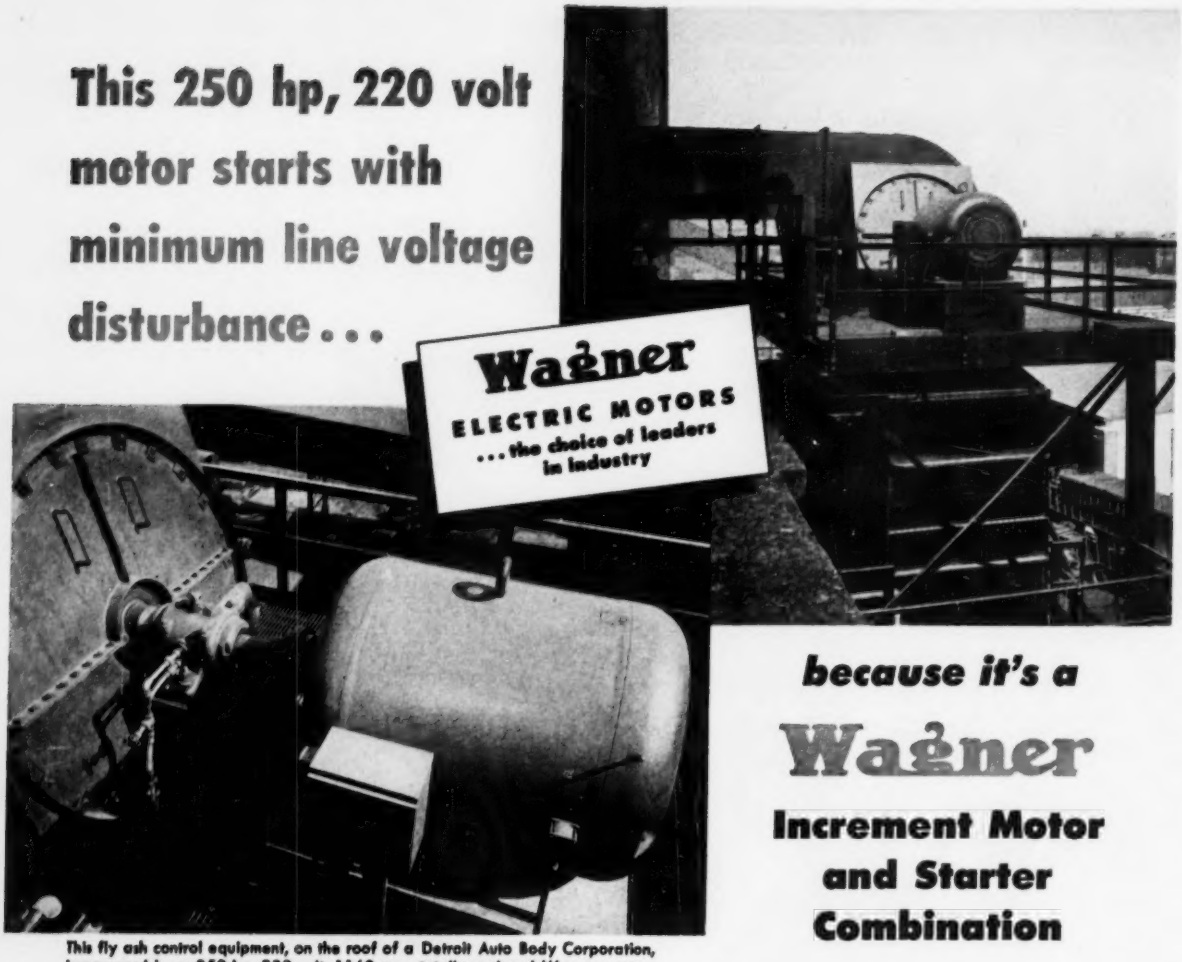
DIVISION

General Office
208 So. La Salle St., Chicago 4, Ill.

Warehouses and Sales Offices Coast to Coast

UNITED STATES STEEL

This 250 hp, 220 volt motor starts with minimum line voltage disturbance . . .



This fly ash control equipment, on the roof of a Detroit Auto Body Corporation, is powered by a 250 hp, 220 volt, 1160 rpm, totally-enclosed Wagner motor.

because it's a Wagner Increment Motor and Starter Combination

The part-winding increment motor and starter combination (pioneered by Wagner) provides an economical method of starting polyphase squirrel-cage motors for any application where reduced current draw at start is required or desirable. No auto-transformers or resistors are necessary.

Voltage disturbances on the line are reduced because current taken from the line is not broken during the starting period—as is the case when auto-transformers or compensator-type starters are used.

You benefit when you install a Wagner increment motor and starter "package" because you get a highly efficient, most economical, motor and starter combination that limits inrush of motor current to values that are acceptable to most power companies for all or parts of their distribution systems.

* * *

When you standardize on Wagner Motors—you get the advantages of a liberal warranty . . . of nationwide service facilities, with on-the-spot service, replacement motors and parts available from 25 Wagner-owned Service Branches and more than 750 Authorized Service Stations. You can choose from a wide variety of types and sizes (from 1/125 to 400 hp.) Bulletin MU-185 gives complete information—write for your copy. Bulletin MU-128 gives full information on Wagner Increment Motor and Starter Combinations.

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Wagner Electric Corporation EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

See our exhibit — Booth 432, 8th All-Industry Refrigeration and Air Conditioning Exposition.

M53-6

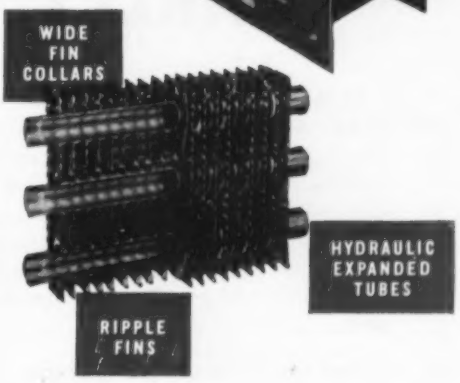
Minnesota, home of McQuay, is America's headquarters for four distinct and glorious seasons. To many, Minnesota's powerful black bears have the right idea—to hibernate during the rugged sub-zero winters.

By specifying McQuay equipment, you can assure your customers that there will be no need for them to go into hibernation or to migrate to the south.

Ripple Fin coil construction, an exclusive McQuay feature, is the product of years of research aimed at producing the ultimate in heat transfer for any weight metal. High efficiency is assured by forcing the air to follow an ever-changing direction of flow in passing through the coil. Thus the air repeatedly contacts the coil surface to give maximum contact time, maximum contact velocity, and a resultant optimum heat transfer.

The staggered tube and rippled edge features also contribute greatly to the construction ruggedness of the famous McQuay line.

McQuay heating coils are available in a wide variety of styles and sizes. Hot water, cold water, brine, direct expansion, and refrigerant condensing coils are available for practically every type of application. Write McQuay Inc., 1601 Broadway St. N.E., Minneapolis 13, Minnesota. Representatives in principal cities.

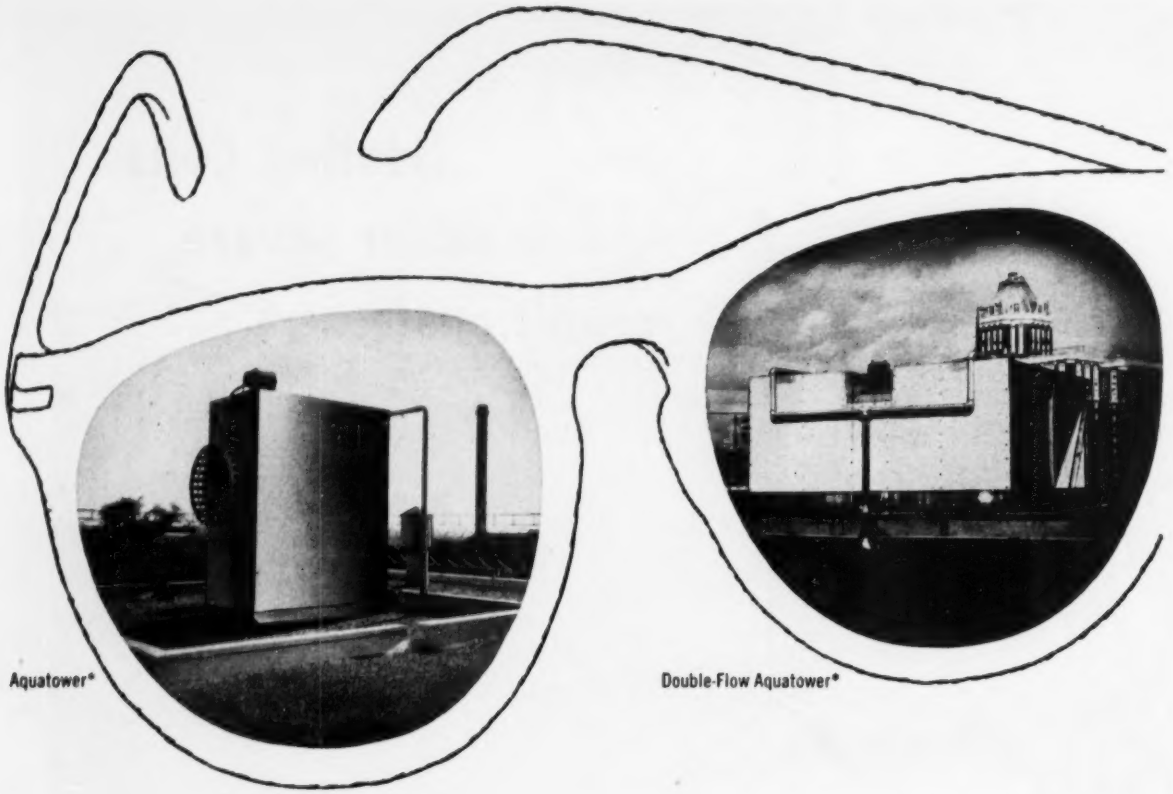


McQuay INC.

N E W S

MAKE THE SEASONS COME TO YOU

HEATING • AIR CONDITIONING REFRIGERATION



Aquatower*

Double-Flow Aquatower*

Engineering "SPECS" reflect preference for

MARLEY Cooling Towers

In the 2- to 60-ton capacity field the call is for Aquatowers and more Aquatowers! These easily installed package units have lifetime nailless redwood filling; completely corrosion-resistant Marmastic lining; simple, easily maintained mechanical equipment. These, plus Marley design, make Aquatowers the world's most popular. Ten sizes are available.

And for the larger jobs (60 tons and up) Marley Double-Flow Aquatowers, the towers with the low silhouette and high performance, are the choice of profession and purchaser. They combine the famous Double-Flow method of complete air utilization, open distribution, close-spaced filling and low draft loss with operational simplicity that is so important to the average operator. Double-Flow Aquatowers are produced in eight sizes, both in wood with asbestos cement board casing and all steel.

Your local Marley application engineer will gladly assist in selecting the tower that precisely fits your "specs."

*Trademark Reg.

MARLEY

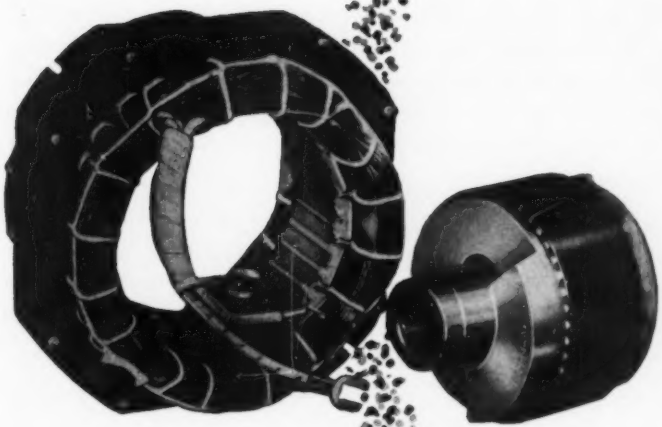
The Marley Company

KANSAS CITY, MISSOURI

lonesome part of a popular product

The hermetic motor—that part of a modern refrigerating unit the user *never* sees—is truly "out of sight . . . out of mind."

And the fact that it is forgotten is a tribute to its design and construction, for here is a motor that must always function perfectly, while permanently enclosed in the compressor housing. *The "forgotten" part of many of America's most dependable refrigeration units is an Emerson-Electric Hermetic Motor.*



You can benefit from Emerson-Electric's 63 years of experience in motor design and production. If you have requirements in ratings from 1/20 to 5 h.p., or hermetic motors from ⅛ to 20 h.p., Emerson-Electric has the right motor for you. Your inquiry is invited.

THE EMERSON ELECTRIC MFG., CO.
St. Louis 21, Mo.

Write for these Emerson-Electric Motor Data Bulletins

Manufacturers requiring motors 1/20 to 5 h.p. can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

- ☐ 445-A Capacitor-Start
- ☐ 445-B Split-Phase
- ☐ 445-C Integral
- ☐ 445-D Fan-Duty
- ☐ 445-E Oil-Burner
- ☐ 445-F Jet Pump
- ☐ 445-G Blower

EMERSON ELECTRIC
MOTORS • FANS APPLIANCES

MAXIMUM STEAM SAVINGS ASSURED WITH

JOHNSON CONTROL

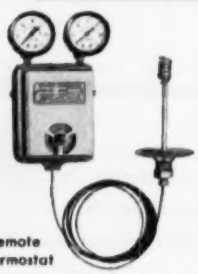
T-403 Single Temperature Room Thermostat

T-385 Electronic Duo-Stat

T-460 *Dual* Two Temperature Room Thermostat

T-901 Submaster Thermostat

V-111 Radiator Control Valve



T-800 Remote Bulb Thermostat

V-103 Coil Control Valve

V-160 Convector Valve

Why do engineers, who insist that only the best is good enough for their heating, ventilating and air conditioning systems, recommend Johnson Control? Simply because they know that they and their clients are best served when the temperature control apparatus is manufactured and the complete system *planned* and *installed* by the same organization!

They know that, when an organization is devoted exclusively to manufacturing, planning and installing automatic temperature control systems, there can be no division of responsibility. The system must fit exactly the needs of the specific heating, ventilating and air conditioning problems which are encountered.

Ask a Johnson engineer from a nearby branch office for recommendations on any temperature control problem—large or small—in both new and existing buildings. There is no obligation. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

MANUFACTURING • APPLICATION • INSTALLING • SINCE 1883

IMPROVED DESIGN!
WIDER RANGE!
SPENCER
TYPE "C"
SPENCER "C" BOILERS
For Larger Homes, Motels, Schools, Churches, Apartments
Commercial and Industrial Buildings
Capacity Range: 1100 to 5000 sq. ft. steam net rating
1760 to 8000 sq. ft. water net rating

SPENCER'S

POPULAR "C" BOILERS NOW OFFER NEW FEATURES ... NEW SIZES ... MORE ATTRACTIVE PRICES!

Now, the most popular series in Spencer's quality line of boilers is available for a wider range of jobs ... and at more attractive prices.

Improved design now makes this outstanding boiler available with standard 15" base or extra base heights, at nominal charge, for special fuel-burning installations. Four new larger models, with heavy 3" fire tubes, have been added to the line, providing greater range in application.

Here are some of the outstanding features of the Spencer "C" Boilers: water-cooled, precision-ground flue and fire-door frames, equipped with heavy cast-iron insulated doors; extra-heavy steel-plate smokeboxes; staggered boiler tubes for rapid heat transfer; service water-heating coils in many capacities.

Entire boiler line available with attractive standard jackets, insulated with glass wool, with beautiful blue-gray hammerloy finish.

Any fuel can be fired in the Spencer "C" Boilers. Easily and quickly converted from hand to automatic firing.

For any job—residential, industrial or commercial—requiring 1100 to 5000-sq.-ft. net load steam, low pressure, specify one of Spencer's "C" Series. *Save dollars and provide the highest quality heating plant available.*

SPENCER HEATER
LYCOMING-SPENCER DIVISION
WILLIAMSPORT PENNSYLVANIA

Spencer Heaters— Dept. HP-103
Lycoming-Spencer Division
AVCO Manufacturing Corp.
Williamsport, Pennsylvania

Dear Sirs:

Please send additional information and specifications on the new Spencer "C" Series Boilers to:

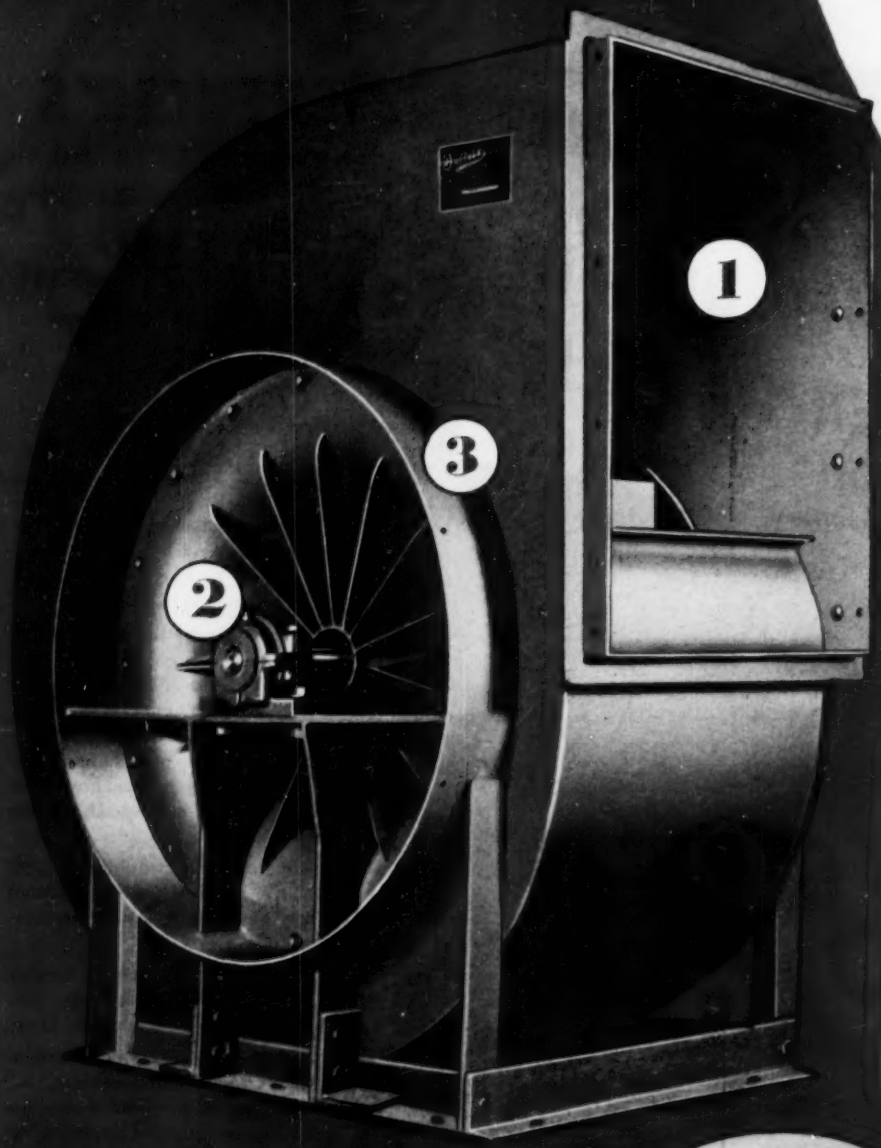
Name_____

Position_____

Company_____

Address_____

City_____ Zone_____ State_____

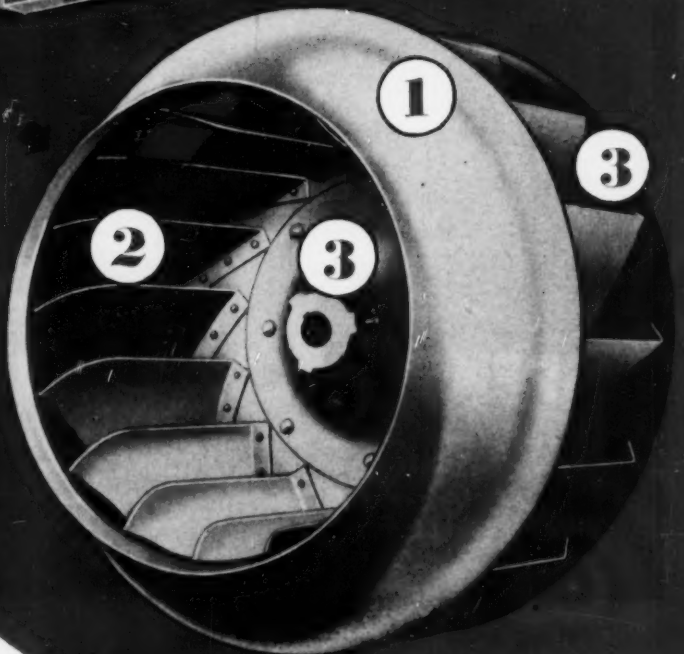


COMPLETE FAN

1. Streamlined housing with outlet designed for most efficient air delivery.
2. Anti-friction or sleeve bearings to suit job requirements.
3. Ample inlet collar for easy connection to ductwork.

WHEEL

1. Heavy gauge die formed shroud, full curvature for proper air flow in wheel.
2. Die formed blades curved and backwardly inclined for stable air flow. Welded and riveted for maximum strength.
3. Solid back plate with extra heavy hub.



CERTIFIED RATINGS

Certified ratings are the result of tests made by the manufacturer in accordance with the Standard Test Code for Centrifugal, Axial and Propeller Fans adopted jointly by the National Association of Fan Manufacturers and the American Society of Heating and Ventilating Engineers.

AUTHORIZED BY NAFM

New!

In our seventy-six years of fan manufacturing, no fan has been more respected for fine performance than the "Buffalo" Type "LL" Ventilating Fan.

This fine performance is now further improved in the new "Buffalo" Type "BL" Limit Load Fan — designed especially for general ventilation, air conditioning and industrial service.

This new fan offers:

(1) High efficiency

(2) Minimum noise level, over wide capacity range

(3) Full Limit-Load horsepower characteristic

(4) Stable performance from shut-off to free delivery

Retaining the husky construction which has characterized "Buffalo" fans for many years, the new Type "BL" has some outstanding quality design features.

The fan inlet is die-formed of heavy gauge steel, with die-formed inlet vanes welded in place. This permits the Type "BL" to give rated performance despite unfavorable inlet conditions frequently present on industrial jobs. Rotor construction includes a die-formed shroud and die-formed blades of backward curvature, so that the resulting self-limiting horsepower characteristic permits selection of driving motors of minimum horsepower.

The Type "BL" fan will be built in standard sizes and arrangements, with rotor diameters from 12¼" to 108¾", to handle from 1,000 to 500,000 cfm.

You will want this superbly-performing new fan with the "Q" Factor* on your next job! Write for new Bulletin F-100, which contains complete engineering details, including performance tables and dimensions.

** The "Q" Factor — The built-in Quality which provides trouble-free satisfaction and long life.*

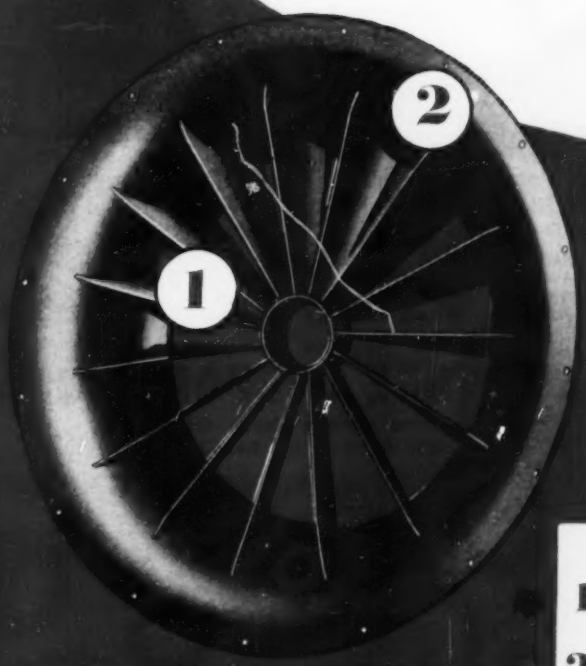
BUFFALO FORGE COMPANY

171 MORTIMER ST. BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Sales Representatives in all Principal Cities



"Buffalo"

TYPE "BL"

Limit-Load FAN

INLET

1 Furnished as standard, and exclusive with "Buffalo", these stationary inlet vanes reduce turbulence and assure rated air delivery in spite of unfavorable inlet conditions.

2 Die-formed inlet bell matches wheel shroud.

ANOTHER REPORT OF READING COPPER TUBE "ON THE JOB"....

F. C. SPETH, Plattsburg, N. Y.
Plumbing and Heating Contractor Says:

"BIG JOB or LITTLE JOB... I install READING COPPER TUBE ...Every Time"

F. C. Speth, plumbing and heating contractor on many outstanding installations through upper New York state and Vermont, has found from experience that whether a job is large or small, he can count on Reading for fast, dependable service. Other reasons cited by Mr. Speth for his preference for Reading Copper Tube are its ease of handling and bending . . . fewer number of joints required . . . uniform high quality resulting from precision manufacture to close tolerance standards . . . and long, trouble-free service.

Reading Tube Corporation is proud of this case history of one more contractor's experience and satisfaction with Reading Copper Tube which is typical of thousands of contractors throughout the United States.

NEW DORMITORY BUILDING AT STATE TEACHERS' COLLEGE, PLATTSBURG, N. Y. in which 15,000 feet of Reading Copper Tube were installed.

ARCHITECTS: Benedict, Ryan & Sayer, Plattsburg, N. Y.
ASSOCIATE ARCHITECTS: Reisner & Urbahn, New York, N. Y.
GENERAL CONTRACTOR: J. J. Harvey, Utica, N. Y.
PLUMBING CONTRACTOR: F. C. Speth, Plattsburg, N. Y.

READING TUBE CORPORATION

Producers of Reading Lektroneal Copper Tubing and Reading 85% Grade A Red Brass Pipe

READING COPPER · BRASS TUBE

Sold Exclusively Through Plumbing and Heating Supply Wholesalers!

OFFICES AND EASTERN DISTRIBUTION DEPOT:
36-12 47th Ave., Long Island City, N. Y. • STillwell 6-9200
WORKS: READING, PA.

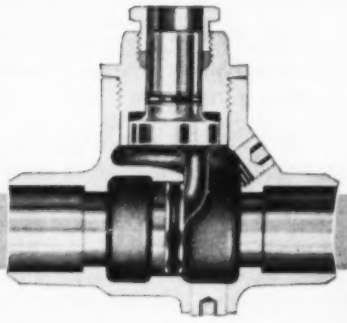
DISTRIBUTION DEPOTS: • Reading, Pa. • Long Island City, N. Y. • Chicago, Ill., 724 W. 50th St. • Houston, Texas, 1121 Rothwell St. • Atlanta, Ga., 690 Murphy Ave., S.W. Unit 5, Bldg. B

O-B EQUATEMP®

. . . one valve for the complete balancing job

Check These Features

- Easy Regulation
- Tight Shutoff
- Top and Bottom Drain Plugs
- Thermometer Well
- Simple Disassembly
- Well Installation Possible
- Double Protection Against Stem Leakage



The Equatemp balancing valve controls water flow in heating or cooling systems *and* acts as a shutoff valve. Since it both balances and shuts off, Equatemp does a job that formerly required two or more valves and fittings.

The shutoff feature is a definite convenience and time-saver for venting or bleeding, draining, or repairing lines. It saves the trouble of shutting off the entire system.

The savings and convenience continue through the life of the valve. Two drain plugs permit venting or draining in any position -- upright or inverted. An easy-to-use Allen-type wrench is furnished for regulating.

Equatemp features rubber "O" rings on both the butterfly type disc and the stem. Conventional packing under nut at top provides *additional* protection against stem leakage.

Equatemps can be used on lines carrying water up to 220 degrees F., and up to 100 pounds gage pressure. For additional information, call your local O-B distributor or write to Ohio Brass, Mansfield, Ohio.

Ohio Brass

MANSFIELD (B) OHIO, U.S.A.

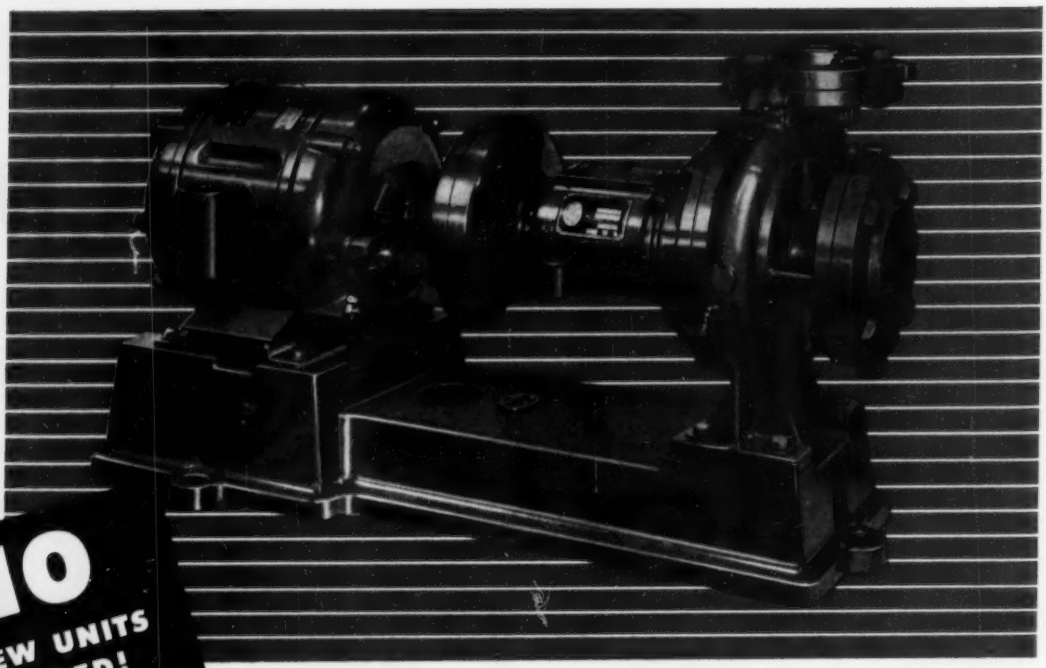
TYPES AND SIZES

The No. 37 solder-type Equatemp for tubing installations can be furnished in $^3/_8$, $^1/_2$ and $^3/_4$-inch sizes. The No. 38 Equatemp, with threaded pipe ends, is available in $^1/_2$, $^3/_4$, 1, $1^1/_4$ and $1^1/_2$-inch sizes.

TYPICAL APPLICATIONS IN HEATING AND AIR CONDITIONING

Floor, Baseboard, Convector, Ceiling, Panel, Unit Air Conditioners, Unit Heaters

4375-V

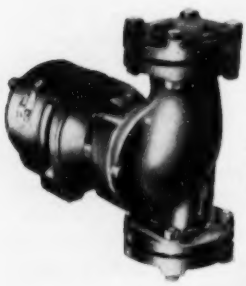


10 NEW UNITS ADDED!

B & G
UNIVERSAL PUMPS

NO JOB TOO BIG OR TOO SMALL FOR B & G *HYDRO-FLO* HEATING PUMPS

¾" to 1½" Boosters
Capacities to 47 GPM
—heads to 12 ft.



2" to 3" Boosters
Capacities to 128
GPM—heads to 19 ft.

PD Boosters—3"
Capacities to 170
GPM—heads to 30 ft.

Enlarged line meets all pumping requirements of larger forced hot water heating systems

For your larger forced hot water heating installations, the *B & G Universal is the pump!* It's the big brother of the famous B & G Booster, with all of the basic features of this biggest-selling circulator. The water-tight seal, for example, polished machine steel shaft with integral thrust collar, extra-long bronze bearings and oil lubrication. Like the Booster, it can be serviced without removing from the line.

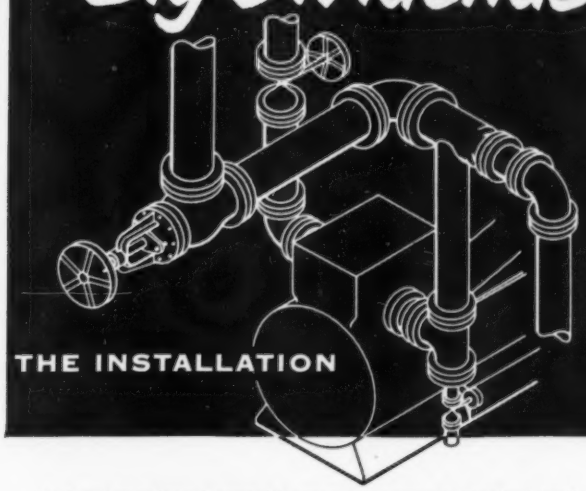
Obviously, the B & G Universal is *not* just another centrifugal pump. It is engineered in every detail to assure that all-important quality of *quietness!*

With heads to 78 feet and capacities to 1,200 GPM, the B & G Universal Pump is suitable for application in garden apartments, industrial plants, institutions and commercial buildings. You can install it with complete confidence in its efficiency and all-around dependability.

Send for new capacity curves.

BELL & GOSSETT
COMPANY
Dept. DD-5, Morton Grove, Ill.
Canadian Licensees S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto, Canada

Thrifty Valve Buying in 1918 Still Paying Big Dividends



THE INSTALLATION

At the American Crystal Sugar Company's Rocky Ford, Colorado, mill where Crane 12-inch iron body angle valves control carbon dioxide to pumps supplying the gas for carbonation process.

VALVE SERVICE RATINGS

SUITABILITY: *Never failed in 35 years*

FEATURES: *Simplified design—easy to service*

MAINTENANCE COST: *None—Routine care only*

SERVICE LIFE: *Installed 1918—still O.K.*

OPERATING RESULTS: *Dependable CO_2 control*

AVAILABILITY: *Crane catalog item—No. 353*

THE CASE HISTORY

This CO_2 service requires valves of utmost dependability to protect process and equipment from damage. In the event of malfunction or failure of pumps, the valves must assure positive closure every time.

That's precisely the quality of performance Crane No. 353 valves have given in this service for more than 35 years. The mill's long inactivity between 75-day production campaigns hasn't made the job easier. Yet, these valves have never been out of the lines for repairs; they've remained on the job since 1918 with only routine maintenance.

Valves that set performance records like this aren't bought on price alone—it's quality that counts most. That's thrifty buying—still the only way of getting the best value.

THE VALVE

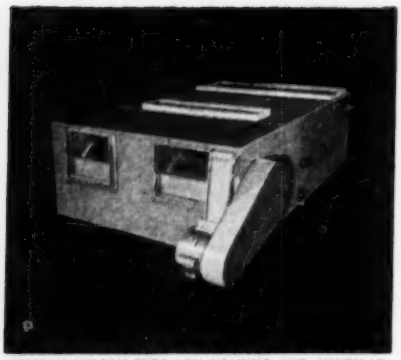
You can see the ruggedness and serviceability of No. 353 angle valves, but it's what's inside that counts most in their better performance. Choose these valves from the complete family of Crane 125-pound iron body globes and angles. It gives you the widest selection of patterns and types for steam, water, oil, and gas. See your Crane Catalog or your Crane Representative.

THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

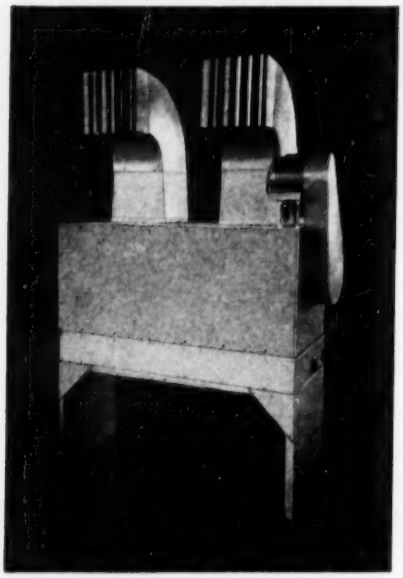
CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

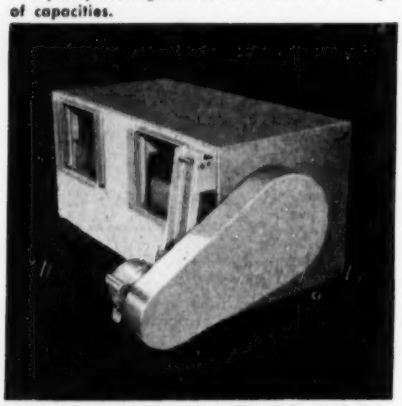
VALVES · FITTINGS · PIPE · PLUMBING · HEATING



HERMAN NELSON TYPE "B" HEATING AND VENTILATING UNIT. This new model features: low outlet velocities—slow fan speeds—a wide selection of heating coils—available with humidifier—and is ideal for institutional and commercial uses.



HERMAN NELSON TYPE "M" CENTRIFUGAL FAN UNIT HEATER. For industrial applications this brand new unit features—high cfm capacities—high heat output—effective air distribution obtained by moderate outlet velocities combined with specially designed nozzles and deflectors. Standard and heavy duty heating coils available in a wide range of capacities.



HERMAN NELSON TYPE "V" VENTILATING UNIT. This new model features one, two or three fans on a common shaft and housed in compact cabinet for straight-line air movement. Especially useful for booster work in ducts—for untempered air supply or exhaust.

herman nelson announces a

NEW LINE

of air handling equipment

CHECK THE FEATURES OF THE NEW HERMAN NELSON LINE

SECTIONALIZED CONSTRUCTION — all units are constructed for easy installation. Cabinet arrangements can be readily changed on the job site if conditions make this necessary.

SERVICEABILITY — easy access to all components is provided. Heating coils are accessible through the top or bottom of the cabinets and there's a hinged access door for filters.

BUILT FOR LONG LIFE — all models have double width, forwardly curved fans mounted on over-sized shafts with permanently lubricated bearings — mounted outside of air stream.

The new line is quality constructed throughout by a company with a long established reputation in the heating and air handling field. Member of the N.A.F.M. and I.U.H.A. and all units tested and rated according to the respective codes.

for complete information — on these new models — write: HEATING AND VENTILATING DEPARTMENT, AMERICAN AIR FILTER COMPANY, INC., LOUISVILLE 8, KY.

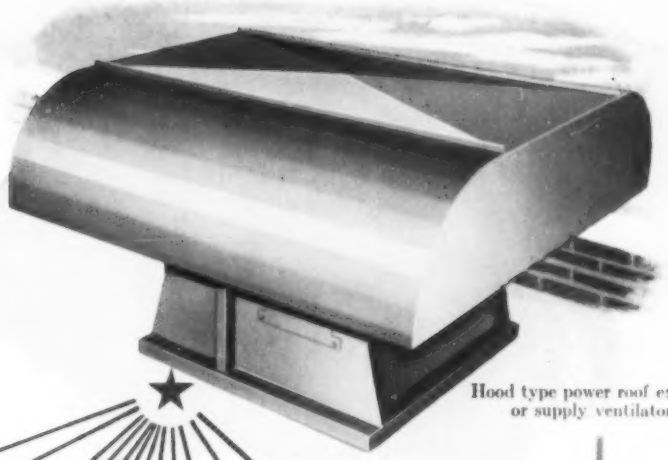
American Air Filter
COMPANY, INC.
373 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

AAF herman nelson

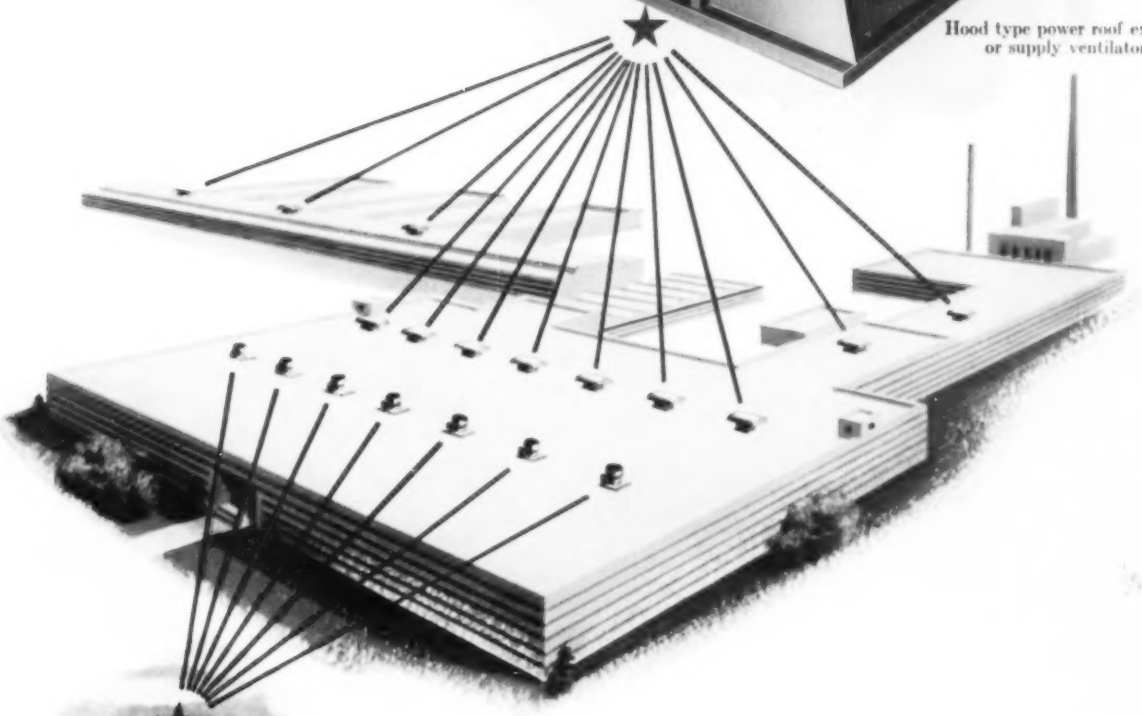
AMERICAN BLOWER

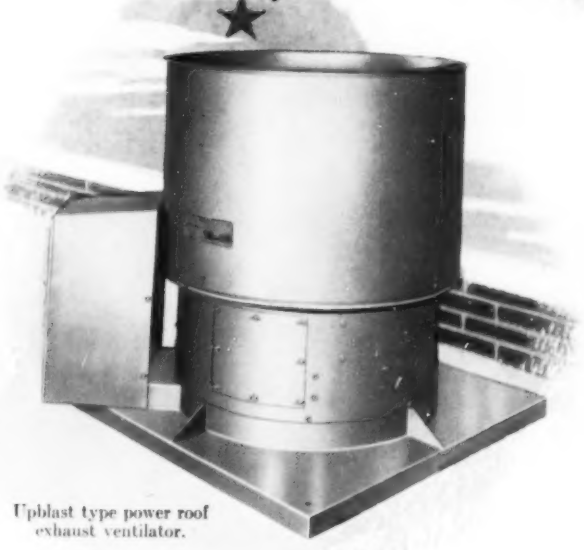
Power

Roof Ventilators



Hood type power roof exhaust or supply ventilator.





Upblast type power roof exhaust ventilator.

American Blower *power* roof ventilators give you the advantages of balanced ventilation, without the uncertainties of gravity units or the expense of a central system.

They're quickly and easily installed on all types of roofs. No extensive duct work is required; no valuable floor space is wasted. Use single units for spot ventilation; several units for large area coverage. American Blower power roof ventilators, supply or exhaust, are available in a wide range of capacities. They are designed to furnish balanced ventilation to industrial plants and commercial buildings.

Ask our nearest branch office for data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS HEATER

have you met our MR. PINCHPENNY?

With one eye on cutting costs and the other on reducing installation and maintenance time, our Mr. Pinchpenny is typical of the many thrifty executives constantly on the lookout for new and better products . . . You can tell from the smile on his face that he has found a real money saver in QUIKUPL®, the patented stainless steel fitting which makes it possible to join pipe or tube without threading or welding. To get the complete story write for Bulletin Q100 today.

Quikupl®

Quikupl means:

1. Lower installation costs
2. Minimum maintenance and down time
3. Quick assembly and disassembly
4. Pressure tight joints
5. Simplified fitting inventories.

THE **COOPER ALLOY** FOUNDRY CO., HILLSIDE, N. J.

LEADING PRODUCERS OF **STAINLESS STEEL** VALVES, FITTINGS AND CASTINGS

the inside story on

ALCO REFRIGERANT CONTROLS

engineered for engineers

see it at the Alco Booth 516-7

All-Industry Show, Cleveland, November 9-12

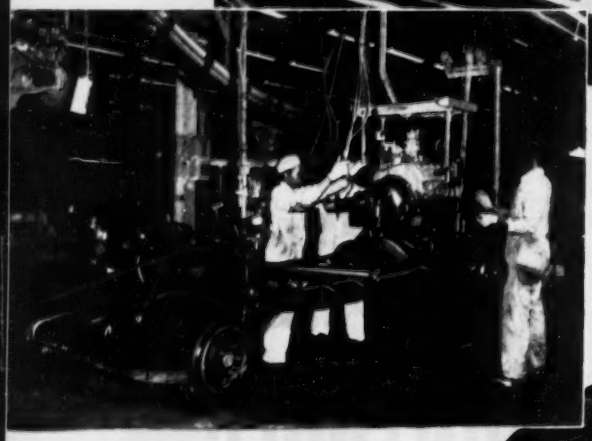
ALCO VALVE COMPANY
861 KINGSLAND AVENUE
ST. LOUIS 5, MO.

5791

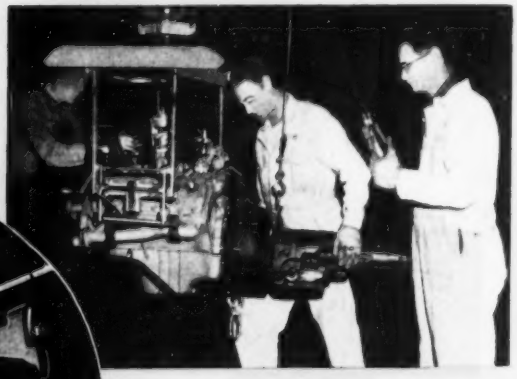
FORD'S *Most Modern*

Above workers in **Cushion Department**

Length of Plant is 1500 feet. Width is 900 feet.



Chassis Line or sometimes called the "Build-up" is the portion of the Assembly Line where the completed engine, brakes, springs and many other items are assembled to the frame.



Motor Line is an example of team work in action. Shown above are three men working on the same engine. One is installing the wiring while the other two are attaching an automatic transmission.

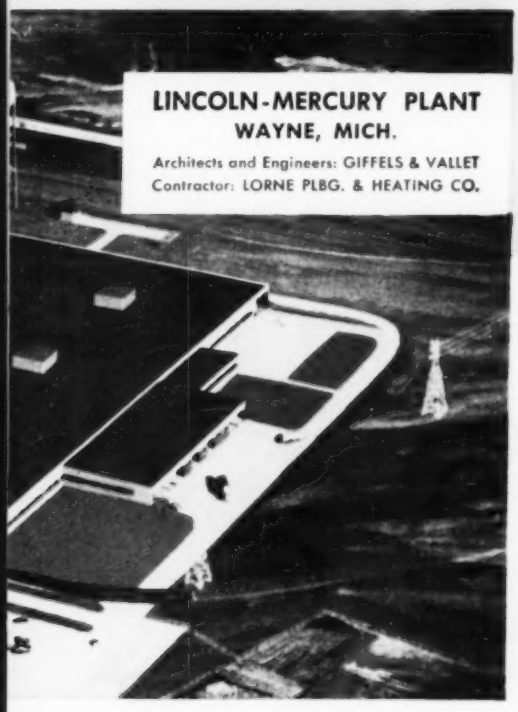
Body Drop (right) is where two assembly lines meet. A trimmed body is lowered on a chassis and becomes the Final Line.

Comfort of employees in the modern **Cafeterias** is assured by Powers Control

POWERS CONTROL

- INCREASES PRODUCTION
- IMPROVES MANY PRODUCTS
- INCREASES OUTPUT OF EMPLOYEES
- REDUCES HEATING COSTS

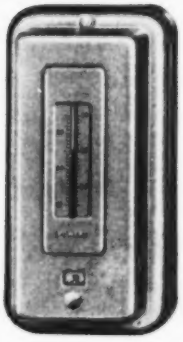
Auto-Assembly Plant Equipped with a



LINCOLN-MERCURY PLANT
WAYNE, MICH.
Architects and Engineers: GIFFELS & VALLET
Contractor: LORNE PLBG. & HEATING CO.

POWERS Pneumatic System of TEMPERATURE CONTROL

Comfortable, Even Heat at the Right Temperature for each department helps improve efficiency of employees and results in



- **Increased Production**
- **Better Products**
- **Lower Heating Costs**

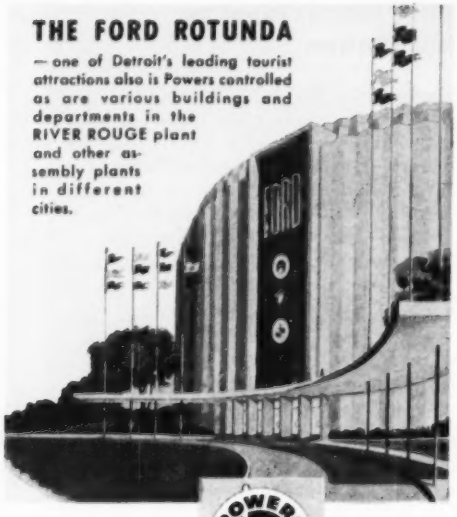
—these are some of the year after year dividends THE FORD MOTOR CO. will receive from its investment in Powers control.

With its almost 1,500,000 square feet of floor space, nine miles of conveyor lines and many advanced features this ultra modern LINCOLN-MERCURY plant is the last word in efficiency. It is a show place among assembly plants.

Into its receiving docks come some 4800 separate parts (with an entire engine as one part). Out of its delivery door, at the rate of 300 cars per 8 hr. day, go completed automobiles tested, checked and ready for driving.

Here a Powers pneumatic control system regulates the steam heating used in the assembly and manufacturing areas and the conditioned air in the paint spray department, first aid and hospital room, cafeterias and administrative offices.

Experience gained by Powers here and in many other important large and small buildings may be helpful to you. When problems of temperature or humidity control arise, contact our nearest office. There's no obligation.

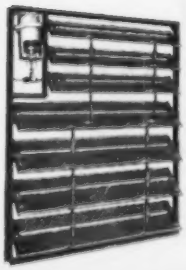


THE FORD ROTUNDA
— one of Detroit's leading tourist attractions also is Powers controlled as are various buildings and departments in the RIVER ROUGE plant and other assembly plants in different cities.

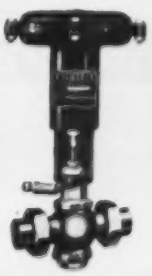
THE POWERS REGULATOR CO.

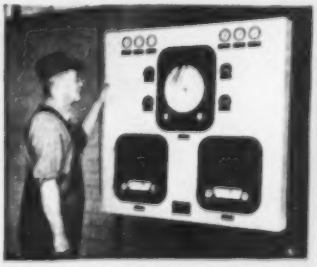
Since 1891 — SKOKIE, ILLINOIS • Offices in Over 50 Cities • See Your Phone Book

'53 (b27)

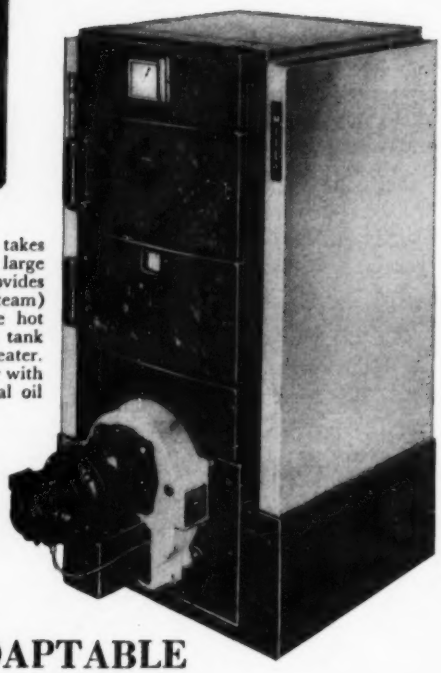


. . . eliminate packing maintenance, leakage of water or steam, or loss of vacuum.





The Smith-Mills "100" takes up no more space than a large wardrobe trunk. It provides fast heat (hot water or steam) and the luxury of ample hot water . . . either built-in tank type or "tankless" heater. Comes with flush jacket or with jacket extension to conceal oil burner.



1853 1953

They carried big boilers through little doorways

. . . and we still do

Ulysses S. Grant was President of the United States. The War Between the States had ushered in a new era. People—and ideas—were on the move.

One of these ideas was hot water and steam heating, pioneered since 1859 by H. B. Smith & Company. Rapid strides had been made in the improvement of its sectional cast iron boiler, and in piping, valves and radiators. And many business leaders were having their homes remodeled to enjoy this new form of central heating.

H. B. Smith & Company was jack-of-all-trades in this work. Its employees designed, estimated, sold and installed heating systems from Washington, D. C. to Portland, Maine. For there were few heating engineers and no heating contractors. In fact, many of the earliest contracting firms were founded by men who got their training in the manufacturing and erecting crews of H. B. Smith & Company.

And so a new and important group of trade and professional men developed . . . men who over the years have brought to American homes and industry increasingly efficient and economical heating systems. Recognizing the desire of the heating contractor to serve his customers with the finest possible products, The H. B. Smith Company constantly strives to fulfill its obligation by providing the last word in heating equipment.

• MORE ADAPTABLE
• BETTER LOOKING
• LOWER COST

. . . the H. B. Smith-Mills "100" is ideal for the Average Home Installation

Now . . . more than ever before, the Smith-Mills "100" Boiler-Burner Unit is the answer to the heating and hot water requirements of the average home. The record of the "100" since its introduction has been one of top efficiency and low maintenance cost. Always a prime favorite among heating contractors, architects and builders, the boiler's latest improvements make it adaptable for practically every home of average or "average-plus" size.

All of the outstanding, time-tested features of the unit have been retained — *with important improvements:*

Increased Hot Water Capacity — A line of tankless heaters with capacities up to four gallons of hot water per minute! The largest tankless heater available in a unit this size.

Improved Appearance — Attractive jacket in new Centennial "Hammertone" Blue enhances the appearance of the entire unit.

Lower Cost — The "100" boiler-burner unit provides a top-quality installation where building budgets are modest.

Now, more than ever before you can specify the Smith-Mills "100" Boiler-Burner for *BIG* boiler performance in a residential unit.

A CENTURY IN '53

OUR YEAR OF GREATEST PROGRESS

H.B. Smith

CAST IRON BOILERS

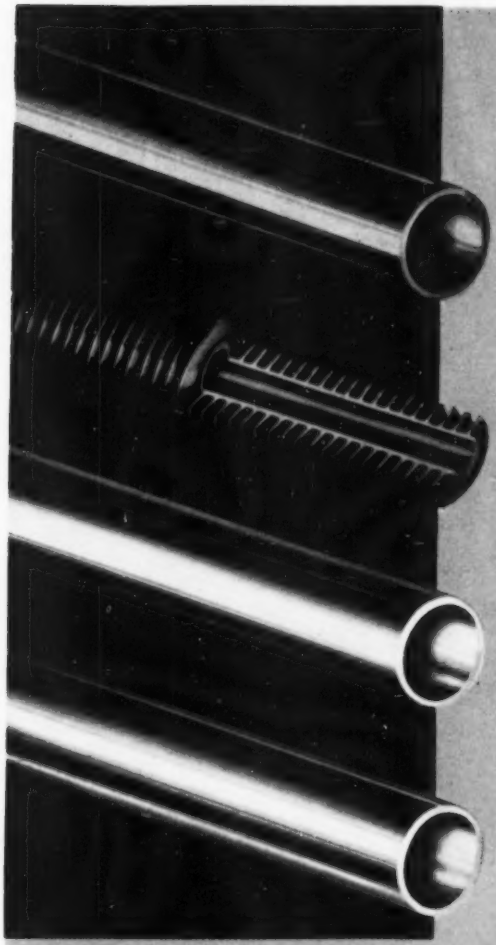
EASIEST TO INSTALL • EASIEST TO SERVICE • EASIEST TO EXPAND

THE H. B. SMITH CO., INC., WESTFIELD, MASSACHUSETTS

Established **1853**

4 WOLVERINE PRODUCTS for You!

PRIME EXAMPLES OF "Tubemanship" AT WORK!



● PLAIN COPPER TUBE

Wolverine tube of copper and copper-base alloys is produced under exacting controls—controls which have been developed through thirty-seven years of experience in top-quality tube manufacture. Some people call it experience—we like to call it Tubemanship. Besides round tube, Wolverine also manufactures a variety of fabricated parts exactly to your prints, including shapes made by the patented Wolverine Spun End Process†.

● INTEGRAL FINNED TUBE

Wolverine Trufin*—the integral finned tube—provides the following advantages: (1) gives you greater surface area in a given space, (2) resists vibration, (3) withstands sudden temperature changes, (4) can be formed as easily as plain tube. Wolverine Trufin is made in a wide range of sizes, fin heights and spacings. It is available in copper, copper-base alloys, aluminum, low-carbon electric-welded steel, type 304 stainless steel and in bi-metal.

● ELECTRIC-WELDED STEEL TUBE

Here again, Wolverine Tubemanship pays off. The same attention to detail, the same quality control standards have been combined to produce a dependable new product: Wolverine electric-resistance welded steel tube. Wolverine electric-resistance welded steel tube is produced in sizes ranging from ¼" through 3" O.D. —and in the following analyses: SAE 1010, SAE 1015, SAE 1020, SAE 1025, SAE 1030.

● ALUMINUM TUBE

Aluminum tube, too, is another product—made better with the help of Wolverine Tubemanship. You can get it in 2S and 3S aluminum and in standard sizes from ¼" through 2" O.D. Wall thicknesses range from .020 through .180. Remember that Wolverine makes Trufin of aluminum or bi-metal—aluminum with a copper lining.

IMPORTANT—When next you order tubing or tubular parts—specify Wolverine. For additional information on these and other Wolverine products—write us. There's no obligation.

*REG. U. S. PAT. OFF.

†A PATENTED PROCESS RE 22465

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

WOLVERINE TUBE DIVISION

of CALUMET & HECLA, INC.

ESTABLISHED 1916

Manufacturers of Quality-Controlled Tubing

1419 CENTRAL AVENUE • DETROIT 9, MICHIGAN

Plants in Detroit, Mich. & Decatur, Ala. *Sales offices in Principal Cities*

EXPORT DEPT., 13 E. 40th ST., NEW YORK 16, N. Y.

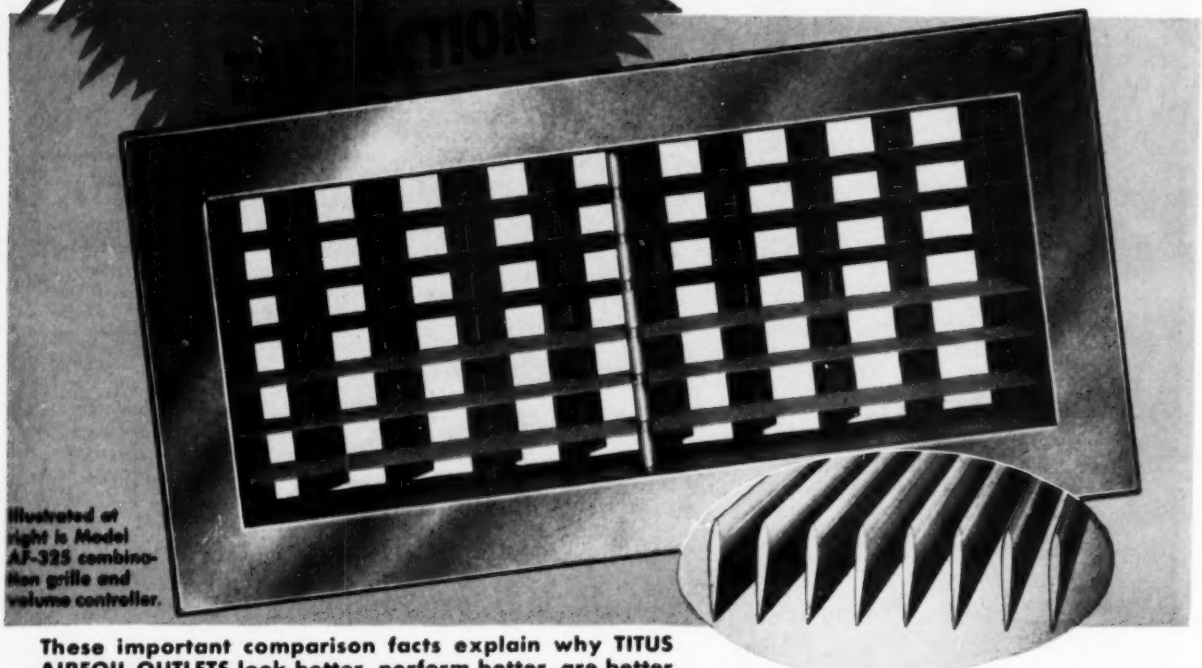
IMPORTANT MESSAGE

To everyone responsible for the specification and installation of air conditioning outlets.

IF YOU ARE GETTING LESS THAN EVERY SINGLE ONE OF THESE FEATURES IN EVERY OUTLET YOU USE...*YOU ARE NOT GETTING YOUR MONEY'S WORTH.*

...*See for Yourself*

COMPARE



Illustrated at right is Model AF-325 combination grille and volume controller.

These important comparison facts explain why TITUS AIRFOIL OUTLETS look better, perform better, are better constructed, *OUTMODE* all other outlets.

They are built above and *beyond* average demand, yet cost is kept at standard prices.

Illustrated above cutaway view showing solid section, streamlined Airfoil Louvers.

1 75% TO 85% FREE AREA . . . . Greater than ordinary grilles.

2 EASY 4-WAY ADJUSTMENT . . Not necessary to remove or invert grille to get complete 4-way adjustment.

3 INSTALLS IN 1/10 ORDINARY TIME . . . . . .

Workmen need not remove grilles. Dirty hands never touch grille or wall to leave dirty, expensive smudges.

ORDER *A Sample* TITUS GRILLE

IT FEATURE FOR FEATURE WITH EVERY OTHER GRILLE ON THE MARKET TODAY

4 SOLID SECTION AIRFOIL LOUVERS . . . . . Smooth as glass. Streamlined. Eliminate turbulence. Control air properly.

5 ONE-PIECE FRAME . . . . . . Adds new beauty to any installation. No unsightly corner cracks or corner patches.

6 EXTRA STRENGTH . . . . . . Without clumsy bulk. Easy to carry. Easy to handle.

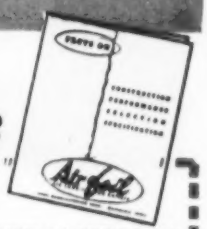
7 CLEAN WITHOUT REMOVING GRILLE . . . Removable core not necessary. Made available, however, if desired.

8 LOW NOISE LEVEL . . . . . . Streamlined louvers handle air with near perfect performance. Hold noise level to absolute minimum.

Before you start your next job, order a sample grille. Prove to yourself by *True* comparison . . . holding the grille in your hands . . . that you get better grille construction, more beauty, and consequent better grille performance from TITUS OUTLETS. ORDER TODAY.

* SALES OFFICES IN ALL PRINCIPAL CITIES

FREE 1953 CATALOG



MAIL COUPON NOW

TITUS MANUFACTURING CORP.,
WATERLOO, IOWA

CHECK TYPE OF GRILLE ON WHICH SPECIAL INFORMATION IS DESIRED.

- ☐ Air Conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Door ventilators
- ☐ Special made-to-order grilles
- ☐ Send complete New 1953 Catalog

NAME _____

ADDRESS _____

CITY _____ STATE _____

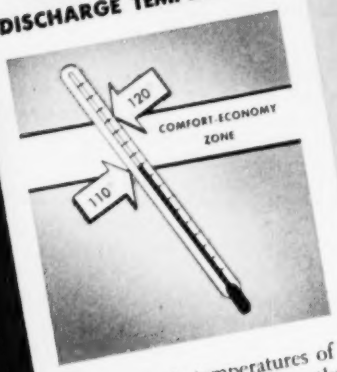
Before you buy any unit heater

MODINE STEAM and HOT WATER units that top the field

Compare

In addition to horizontal delivery models, Modine offers a new line of vertical units for both steam and hot water. New, improved design is lighter, smaller, yet gives you *greater capacity.*

Compare
DISCHARGE TEMPERATURES



Discharge air temperatures of 110° to 120° F. are correctly related to air velocities — the key to perfect heating comfort plus lower fuel costs.

Compare
HEAT THROW

No one but Modine gives you a built-in velocity generator that effectively steps up heat throw, assures positive heat penetration of cold air strata near floor.

Compare **LONG LIFE**

Modine's advanced engineering is combined with superb styling and highest grade materials. Your assurance of long years of trouble-free service. *But see for yourself!* Call the Modine representative listed in your phone book, or write for Bulletin 153 on Modine Steam and Hot Water Unit Heaters.

Modine

...steam, hot water or gas...

Modine WITH ALL OTHERS!

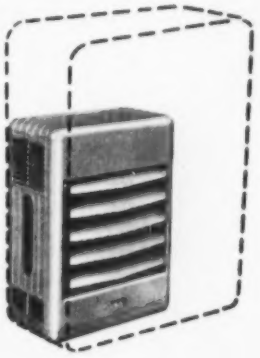
Modine Gas-Fired Unit Heaters are built in a full range of popular sizes. All are A.G.A.-approved for natural, mixed, manufactured, L.P. and L.P.-air gases.

GAS-FIRED units that top the field . . . with *stainless steel* heat exchangers and burners

Compare

EASE OF INSTALLATION

Advanced stainless design makes Modines 50% lighter in weight—more compact than the average of seven other leading makes. Installation is faster, easier — no need for special structural supports. On one job, it cost the heating contractor $600 less to install 66 Modines than conventional units — savings he passed on to the owner.



Compare

PERFORMANCE

EVEN HEATING | MODINE | CONVENTIONAL

Not only do Modine units resist corrosion — all tubes heat uniformly because they're individually fired. Burners have elongated ports with four times the free area of ordinary drilled ports for maximum combustion efficiency. Remember: with Modines you are *sure* of getting full rated capacity.

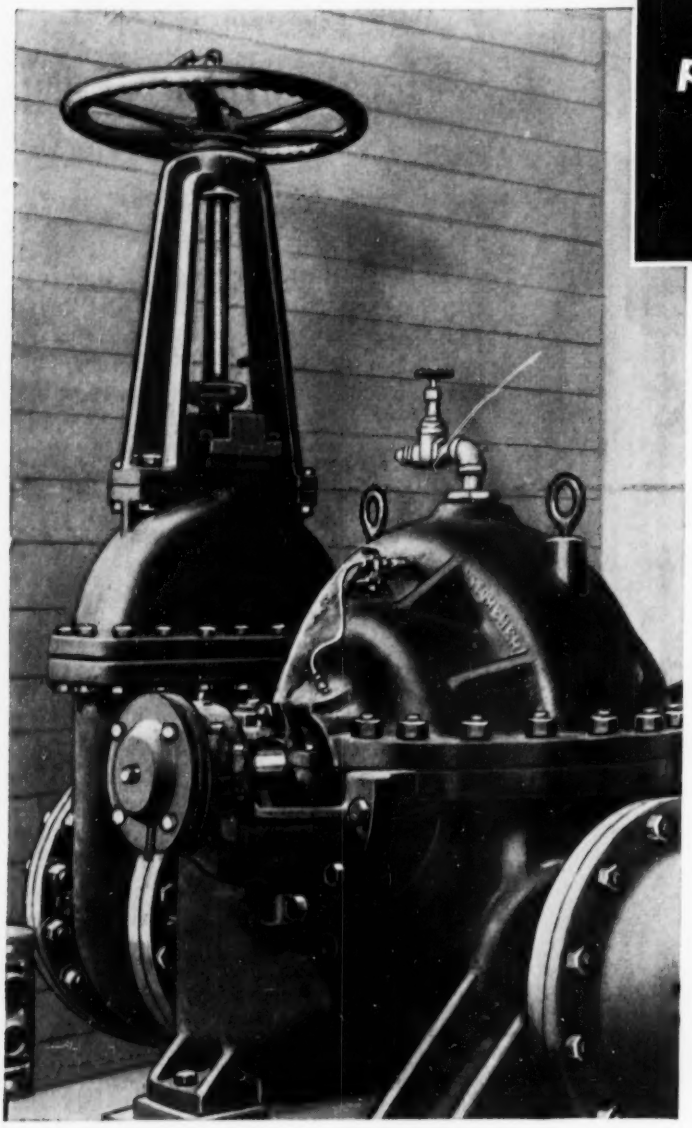
U-1202

Compare ALL-AROUND VALUES

As the leader in the development and application of steam and hot water unit heaters for more than 25 years, Modine brings unequalled experience to gas unit heating problems. It is the *only* manufacturer to publish heat throw data for gas-fired units. For facts, ask for Bulletin 653. Modine Mfg. Co., 1563 DeKoven Avenue, Racine, Wisconsin.

UNIT HEATERS

"Buffalo" Tips on Better Pumping



"Buffalo" Type SL Double Suction Pump. For Engineering data, write for Bulletin 955.

The cheapest pump is the one that lives up to expectations

First cost is the smallest part of what the wrong pump could cost you, once installed. If it fails to meet capacity and pressure requirements, it means costly replacement or supplementary pump units. Or if the pump is not built to stand up on the job, the owner is in for more expense and dissatisfaction.

"Buffalo" Pumps cost a little more to build — and by the same token, a lot less to run. Only the finest workmanship and materials go into them. Impellers, shafts, stuffing boxes and bearings are oversize. Water passages are simply formed. All parts are readily accessible. And whether you need a boiler feed pump to handle 300 gpm at 1400' head, a water pump to handle up to 10,000 gpm, or a single suction pump for, say, zone air conditioning, "Buffalo" makes the right model and size for the job. What's more, it's load-tested before delivery, and you can be sure of performance right up to rated capacity. On your next job, make it "Buffalo" and see.

Write for your copy of Bulletin 955

BUFFALO "Buffalo" PUMPS, INC.

171 MORTIMER STREET BUFFALO, N. Y.

Subsidiary of Buffalo Forge Company

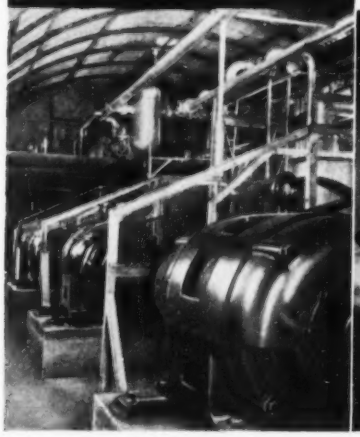
Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

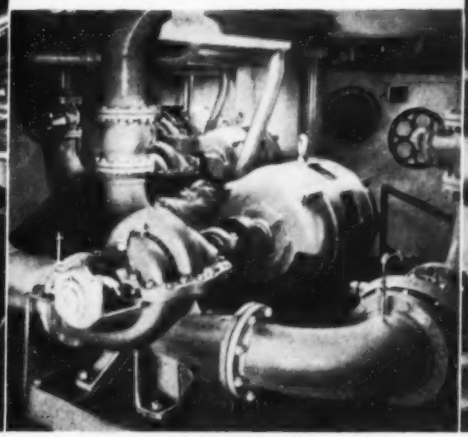
Large or Small...

Century MOTORS

Are Designed to Provide All the Performance That Is Built Into the Machines They Drive



Century 125 H.P. motors driving ammonia compressors for ice for the Falcon Dam, which is under construction on the Rio Grande River.



Century 125 H.P. motors on circulating pumps for condensing units. They serve the refrigeration system of a large department store.

Century 125 H.P. motors on circulating pumps for chilled water. Used in the same department store.

Your nearest Century District Sales Office or a convenient authorized Century Distributor will be glad to give you complete information.

Here are some typical examples of equipment powered by large Century motors, which were application engineered for TOP PERFORMANCE.

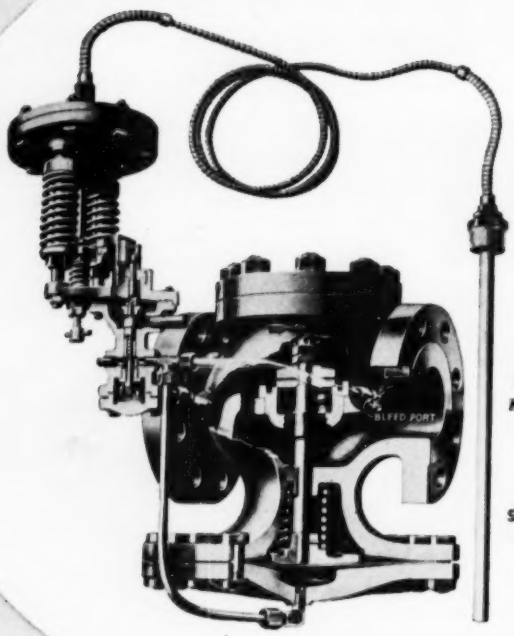
Matching the operating characteristics of your equipment is made easy through Century's wide line of single phase, polyphase and direct current motors to choose from. They are made in many types, ranging in size from 1/8 to 400 horsepower, with literally hundreds of specifications adaptable to specific applications.

Get Top Performance of your equipment through skillful motor application by specifying Century motors on the equipment you buy and for replacement.

CE780

CENTURY ELECTRIC CO.
1806 Pine St., St. Louis 3, Missouri
Offices and Stock Points in Principal Cities

3 Reasons for Accurate Regulation



PACKLESS CONSTRUCTION

LARGE BALANCED METAL DIAPHRAGM

SENSITIVE PILOT

Spence

Packless construction eliminates the need for closely fitted parts that may stick or bind due to dirt or uneven expansion of the parts.

In Spence Temperature Regulators, the Main Valve is actuated by a large balanced metal diaphragm which responds to the slightest changes in temperature.

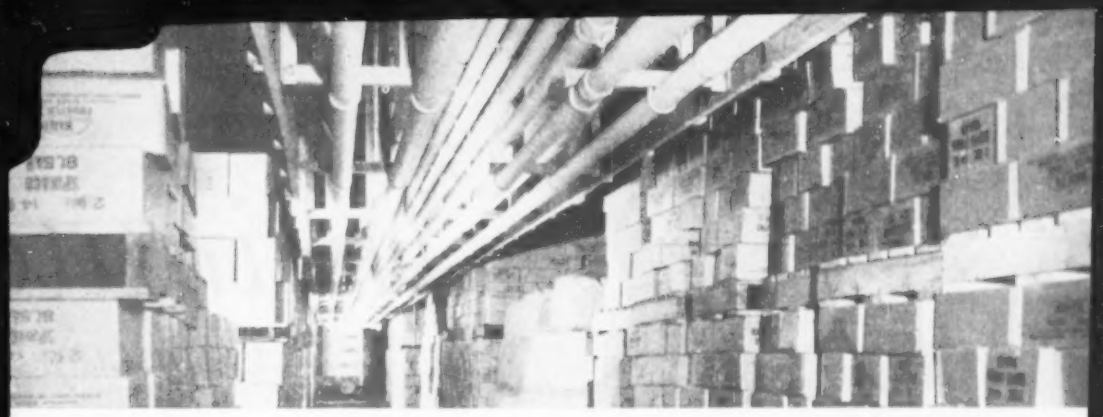
Sensitive Pilots are designed to limit heater pressure to an adjustable maximum. As the temperature at the thermostat drops a few degrees there is a corresponding increase in steam pressure up to the limit for which the Pilot is set.

With regulators that respond only to temperature, an increase in load is accompanied by a momentary decrease in steam pressure caused by faster condensation in the heating element. There is a time lag until the thermostat senses the temperature drop and opens the valve wider. Spence Temperature Regulators act like pilot operated pressure regulators when this occurs. They respond instantly to maintain the steam pressure until the thermostat has a chance to further increase it as needed for the heavier load.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year, without requiring extensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.

SPENCE ENGINEERING COMPANY, INC., Walden, New York



STOP COSTLY PIPE-LINE FAILURES

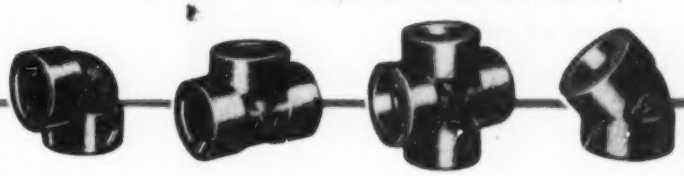
No one knows better than you the increasingly high cost of unscheduled outages due to pipe-joint failures. But do you know just how far it is possible to go toward *eliminating* such failures throughout the life of your piping systems? The answer to this critical problem in production and maintenance costs is FORGED STEEL FITTINGS by the pioneer firm of Watson-Stillman—consultants and suppliers to *all* major industries concerned with pipe joining and maintenance.

Watson-Stillman fittings are FORGED for maximum strength, toughness, and resistance to corrosion, vibration, and shock. More uniformly precise in all dimensions, they are the modern go-between wherever pipes meet permanently.

Leading Refineries, Chemical Plants, Public Utilities, Refrigeration and Industrial Plants throughout the world stay on stream at lowest cost-per-year with the famous Double-Diamond Fittings by Watson-Stillman. Write for literature.

Screw-End and Socket-Weld Types

SOLD THROUGH LEADING DISTRIBUTORS



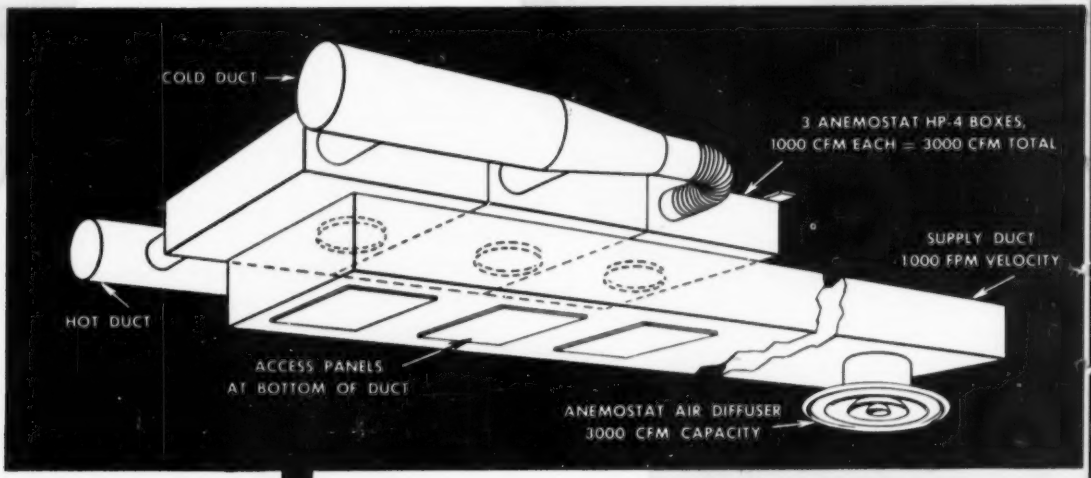
WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

132 ALDENE RD., ROSELLE, NEW JERSEY

9-0-5

High Velocity with Unlimited Capacity



High Velocity air conditioning is constantly posing new problems. Here is one of many for which Anemostat has a practical solution.

PROBLEM:

How can you handle unlimited volumes of air from a single air diffuser on a High Velocity single or dual duct system?

SOLUTION:

Use 3 series HP-4 High Velocity Units in tandem connected to an Anemostat Air Diffuser.

In High Velocity installations, too, "When Anemostat Air Diffusers are in sight the system is right."

ANEMOSTAT®

DRAFTLESS *Aspirating* AIR DIFFUSERS

ANEMOSTAT CORPORATION OF AMERICA

10 EAST 39th STREET, NEW YORK 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

"No Air Conditioning System Is Better Than Its Air Distribution"

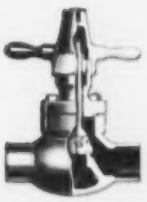
The Industry's confidence in Henry Products is reflected by the largest demand in the Company's production history over the past forty years

See Our Exhibit
Booth 637
8th All-Industry Refrigeration
& Air Conditioning Exposition
Cleveland, Nov. 9-12

HENRY

Valves, Driers and Strainers

Relief Valve



Wing Cap Valve

Packless Valve With Balanced-Action Blue Bantam Type

Packless Valve With Balanced-Action Standard Type

Drier

Ammonia Valve

"Y" Strainer

Angle Type Drier

Henry Valve Co.

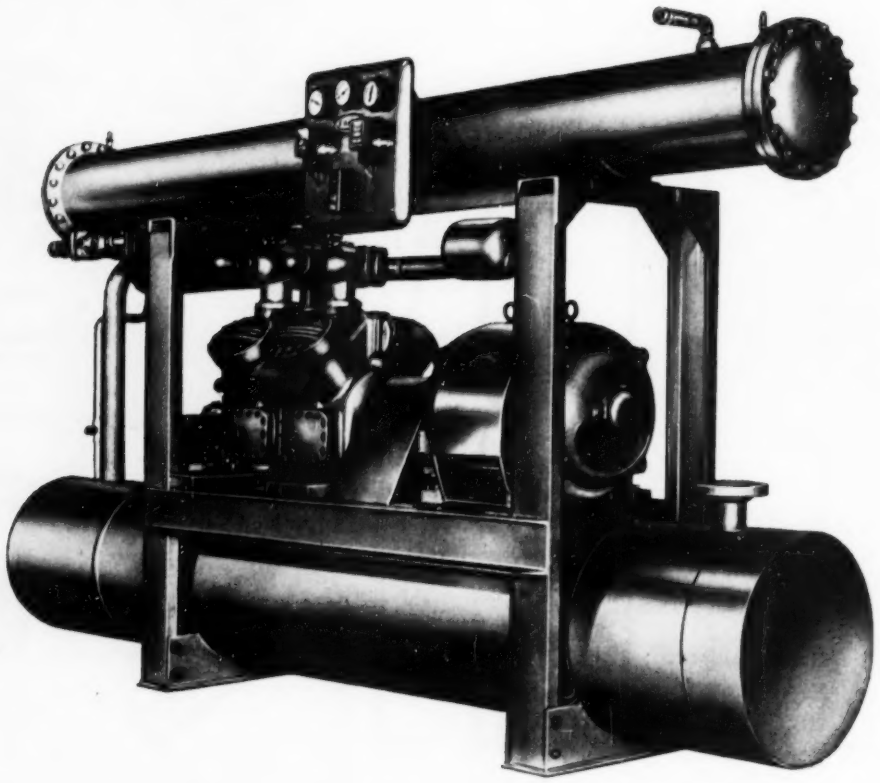
Melrose Park, Illinois (Chicago Suburb)
Cable: Hevalco, Melrose Park, Illinois

HENRY VALVE CO
CONTROLLING FLOW

Valves • Driers • Strainers • Control Devices and Accessories for Refrigeration • Air Conditioning and Industrial Applications

A new, completely assembled water cooling system—by Carrier

saves space, installs easily



This new Carrier 75-hp reciprocating water cooling system, for comfort and process applications, comes from the factory completely assembled, just as you see it here. It makes a neat looking installation.

Only simple connections for water and electric lines are needed. This means far fewer field labor problems.

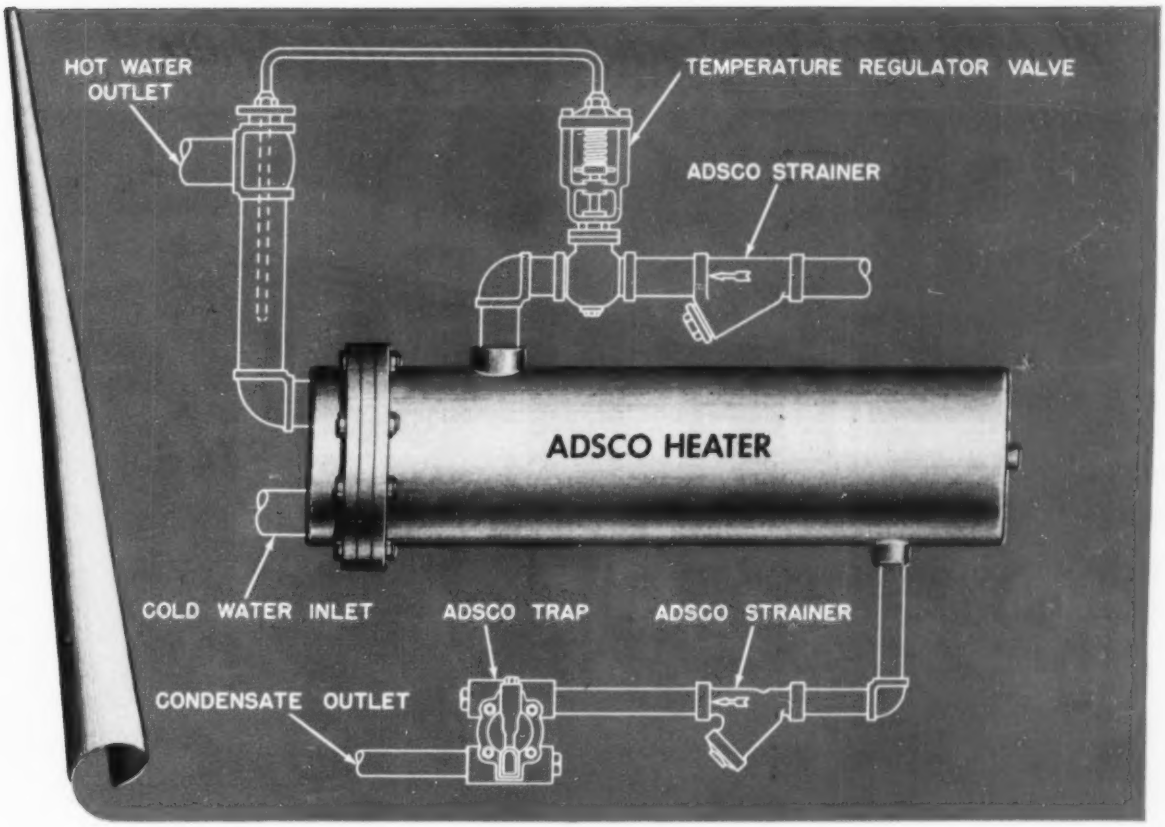
And this new unit is a compact package that fits through a normal-size door. It's only 2½ ft. wide, 6 ft. 11 inches high and 13½ ft. long—can be placed right up against a wall where it's out of the way.

Throughout, there is the careful, exacting, rugged Carrier construction. The big cooler, for instance, is *completely* insulated. Compressor, cooler and condenser are all mounted within a strong supporting frame.

Whenever you need a water cooling system, we'd like to talk with you about it. Please call your local Carrier Branch Office, Dealer or Distributor. You will find them listed in your Classified Telephone Directory. Or write to: Carrier Corporation, Syracuse, New York.

Carrier

air conditioning • refrigeration • industrial heating



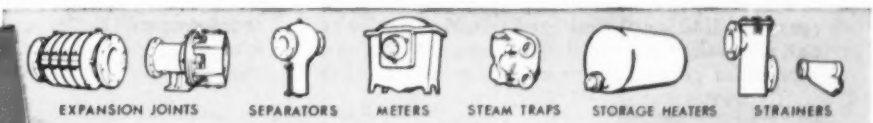
BLUEPRINT FOR ACTION!

And what action, when you use an ADSCO Water Heater! Hot water . . . when and where you want it . . . and at low cost! ADSCO Instantaneous Heaters furnish industry with general service hot water, boiler feed water, and process water. They supply hotels, apartments, office buildings, dormitories, hospitals, and institutions with hot water for showers, washrooms, dishwashers, laundries, and for general cleaning. ADSCO Convertors, a type of instantaneous heater with a shorter temperature range, furnish *all types* of buildings with hot water for quiet, trouble-free space heating systems.

Yes, you get plenty of action — fast action — out of ADSCO Water Heaters. They operate best when connected according to the typical piping arrangement shown above, with two ADSCO Y-type Strainers to protect valuable equipment and an ADSCO Dual Steam Trap to handle condensate efficiently.

ADSCO Water Heaters have only three parts: shell, tube bundle, and cover. All are made to ADSCO's high standards. Steel shells are seamless steel pipe, carefully cut and welded by skilled workmen. The shell flange is sturdy and accurately machined and all openings are precisely located. The tube bundles are made of pure, deoxidized seamless copper tubes formed into U-bends. By means of electrically and automatically controlled equipment, they are rolled and expanded into carefully drilled tube sheets which have a diamond pitch arrangement for spacing of tubes. The semi-steel covers are high-tensile, fine-grain castings.

For further information, write for Bulletin 35-78 on Instantaneous Heaters or Bulletin 35-77 on Convertors.



ADSCO ENGINEERED PRODUCTS

AMERICAN DISTRICT STEAM COMPANY, INC.

NORTH TONAWANDA, NEW YORK

Since 1877

A Prospect for Snow Melting lives here!

The owner of this attractive home is undoubtedly a successful business or professional man. As such he is necessarily intelligent.

He *knows* (1) that men unaccustomed to the routine of strenuous work should not risk the exertion of snow shoveling, (2) that temporary help is usually impossible to get when most needed, (3) that in cases of emergency the ability to get *out* of house or garage is quite as important as getting in, (4) that totaled over the years the cost of snow removal by hand labor reaches an unbelievably high amount.

So, he is a *good* prospect for steel pipe snow melting!

Yes, many home owners in the snowbelts have reasoned it through and have installed driveway and sidewalk snow melting systems not only as a wonderful convenience and safety measure but also as an economically justifiable investment in added property value.

Steel pipe helps to make it so. For steel pipe is economical, durable, weldable and formable for grids and coils, and has a proved background of performance in more than 60 years of conventional steam and hot water heating applications. In fact, for snow melting, radiant heating and other wet heat installations, steel is the most widely used pipe in the world!

A free 32 page color booklet, "Steel Pipe Snow Melting and Ice Removal Systems," has been prepared, answering the most commonly asked questions about snow melting. It includes technical data on design, piping layouts, temperature requirements, boiler capacities and other information for domestic, commercial and industrial uses. Ask for it.

Steel Pipe is First Choice

COMMITTEE ON STEEL PIPE RESEARCH

AMERICAN IRON AND STEEL INSTITUTE

350 Fifth Avenue, New York 1, N.Y.

When you design or install

Weather Modulated Control Systems...

take advantage of this most unusual engineering service!

"ALL-OUT" ENGINEERING SERVICE — Sarcotherm engineering service is in a class by itself. It helps you develop the best control hook-up possible and *carries through* every step of the way.

COMPLETE INSTALLATION DRAWINGS AND WIRING DIAGRAMS — Not just general drawings . . . but complete, tailor-made drawings and diagrams worked up for each individual job.

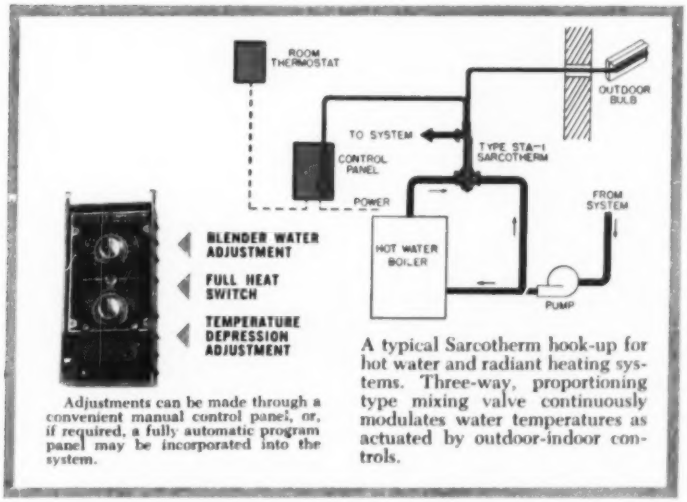
ON-THE-JOB HELP — Contractors get full cooperation and technical assistance backed by many years of experience.

SARCOTHERM offers you an exclusive, all-out engineering service specially designed to save you valuable time in planning and installation.

Its experienced engineering staff is always available. Beginning at the architect's drawing board, Sarcotherm's engineering service extends through the entire job right up to actual operation of the equipment.

Coupled to this service are the basic advantages of Sarcotherm weather modulated controls: simplicity of design; simplicity of installation, operation and maintenance; low initial cost. All these benefits plus unlimited engineering help combine to guarantee you complete user satisfaction and considerable savings in time and operating expense.

Call in a Sarcotherm engineer on your next job. You'll find it profitable. Write for full details.



Adjustments can be made through a convenient manual control panel, or, if required, a fully automatic program panel may be incorporated into the system.

A typical Sarcotherm hook-up for hot water and radiant heating systems. Three-way, proportioning type mixing valve continuously modulates water temperatures as actuated by outdoor-indoor controls.

SARCOTHERM CONTROLS, Inc.

Empire State Bldg., New York 1, N. Y.

An Affiliate of SARCO COMPANY, INC.

Weather Modulated Controls for
HOT WATER, RADIANT AND STEAM
Heating Systems

Close Inspection

This cat picture makes us think of the final inspection of Midwest Welding Fittings. It is equally intense, searching, eye-on-the-ball type. Such final inspection is only one of an exhaustive series of continuous controls and checks that play an important part in assuring the high quality and uniformity of all Midwest Welding Fittings. You can cut your welded piping costs by specifying Midwest Welding Fittings.

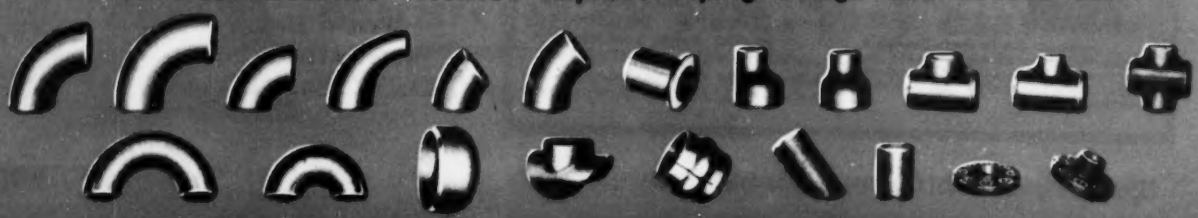
A corner of the Final Inspection Department where every Midwest fitting is individually checked for concentricity, uniformity, and dimensional accuracy. Such checks are the last of a series conducted during production.

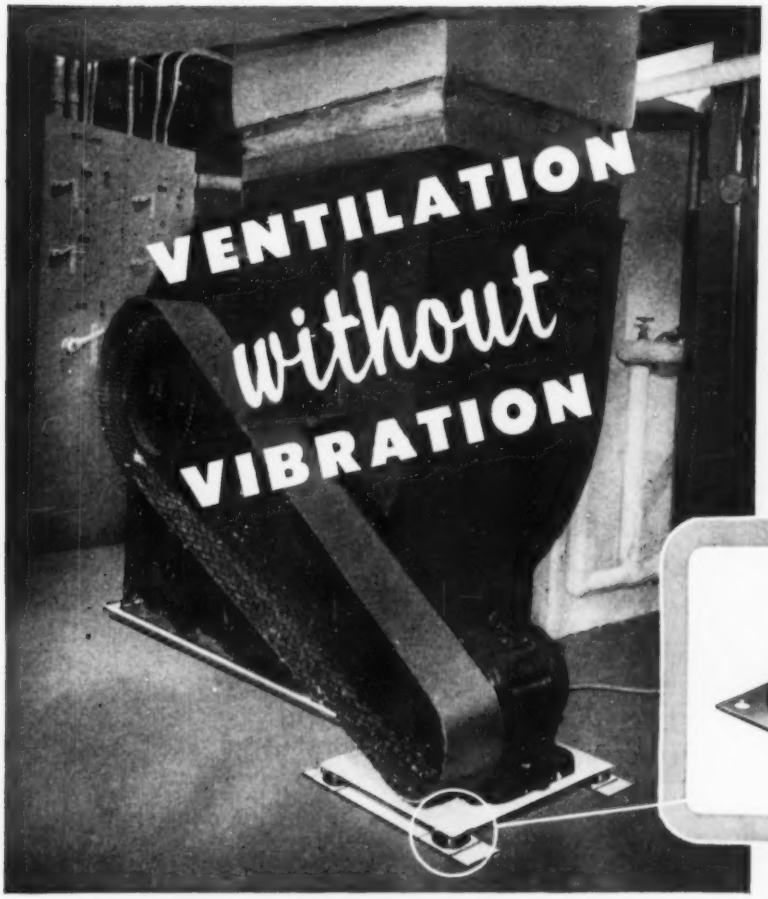
MIDWEST PIPING COMPANY, INC.
Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Passaic, Los Angeles and Boston
Sales Offices: New York 7—30 Church St. • Chicago 3—79 West Monroe St.
Los Angeles 33—520 Anderson St. • Houston 2—1213 Capitol Ave.
Tulsa 3—224 Wright Bldg. • Boston 27—426 First St.
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

MIDWEST WELDING FITTINGS

6104

MIDWEST WELDING FITTINGS Improve Piping Design and Reduce Costs

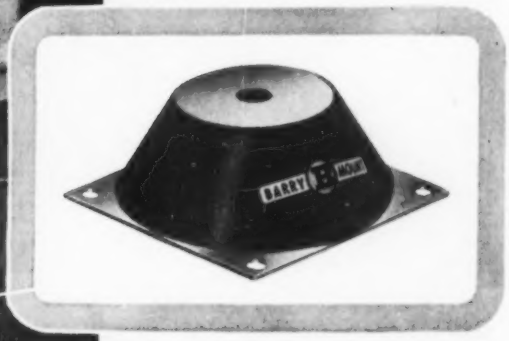




The new Barry fan bases are designed to achieve maximum efficiency in reducing noise and vibration transmitted from heating and ventilating fans and air-conditioning units.

They are engineered by The Barry Corporation, leaders in the field of vibration-isolating equipment for military use, to apply the most up-to-date knowledge to this problem.

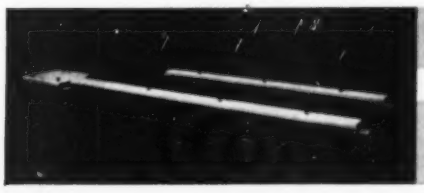
Their detailed design is completed for each particular installation *to meet the exact requirements of that installation*, because this is the only way to assure *maximum performance*.



Noise and vibration from heavy motor-driven blowers proceed partly through the air, from the fan blades and other moving parts of the machinery, and partly by transmission through the building structure from the supporting base.

The key to effective reduction of both vibration and audible noise is a properly-designed isolating support, specifically engineered to take account of the weight of the fan and its motor and housing, the location of the center of gravity, and the operating speed. Barry fan bases achieve maximum efficiency by careful attention to all these factors.

These fan bases incorporate an isolating element of new design, in an integral structure of rails and motor base to fit your exact needs. They are manufactured to your own specifications, custom-built to bring you full satisfaction in actual performance. Write to us today, or get in touch with our nearest representative, so that we may place our experience at your service.

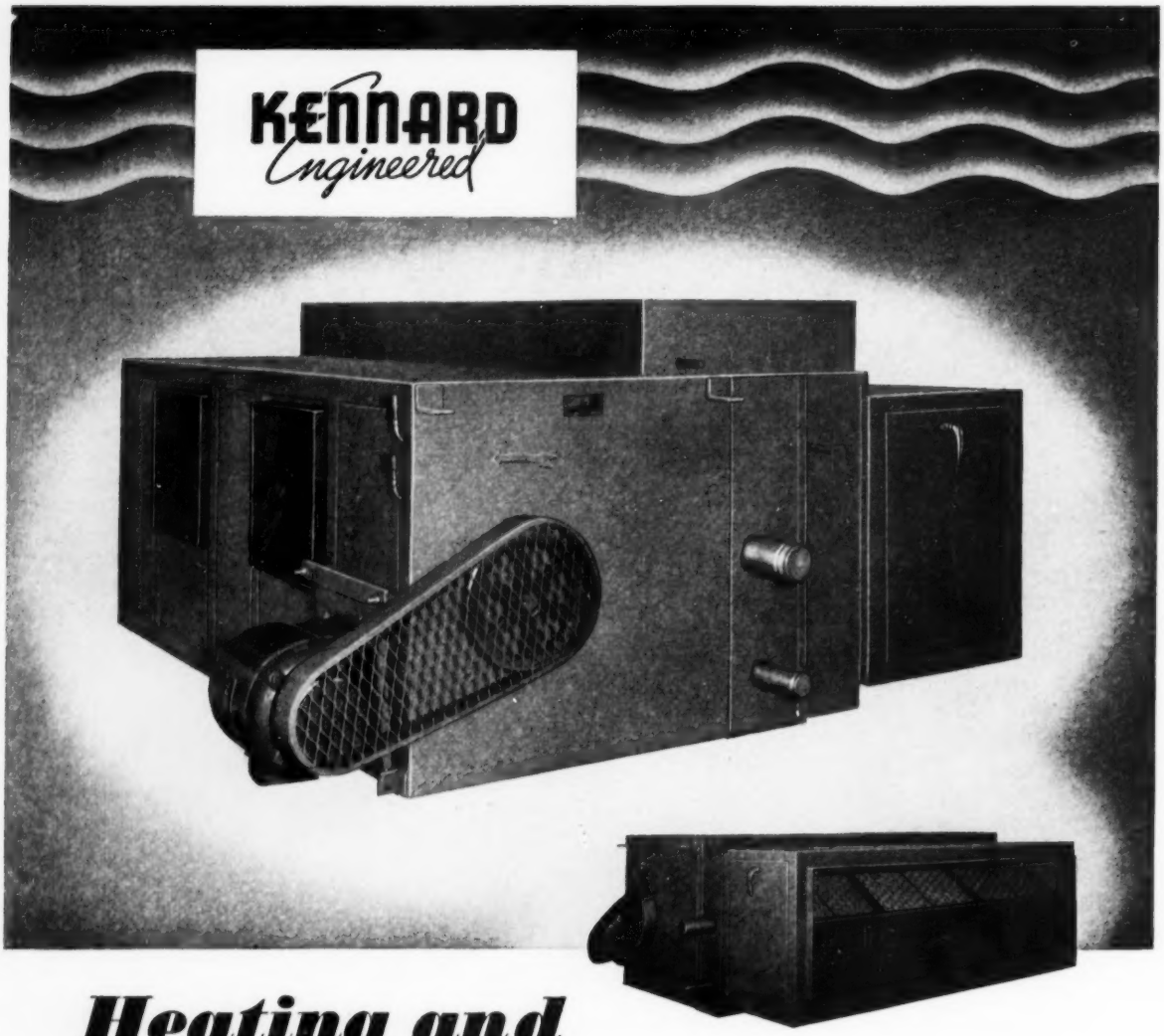


THE **BARRY** CORP.

782 PLEASANT ST., WATERTOWN 72, MASSACHUSETTS

SALES REPRESENTATIVES IN

Atlanta Baltimore Chicago Cleveland Dallas Dayton Detroit Los Angeles Minneapolis New York
Philadelphia Phoenix Rochester St. Louis San Francisco Seattle Toronto Washington



Heating and Ventilating Units

Air Volumes from 400 to 21,000 CFM

Kennard Heating and Ventilating Units are the answer to requirements of heating and filtering recirculated air, fresh air, a mixture of both, or for ventilation only. These ruggedly constructed and easily installed units, conventionally used for heating large spaces or as a central station unit to heat many small rooms, can also be utilized for a variety of special and process applications.

Wall - Floor - Ceiling Mountings

Pre-heat and Re-heat Coils - 1.1 to 32.5 sq. ft. face.

Moderate tip speeds and outlet velocities

Optional Equipment

Mixing Box and Dampers • Face and By-pass Dampers • Throwaway, Cleanable or High Velocity Filters • Target, Grid or Pan Humidifiers.

Representatives in Principal Cities

Write for name of nearest representative and complete information on Air Conditioning Blower Units— Finned Coils — Evaporative Condensers — Cooling Towers — Sprayed Coil Dehumidifiers.

KENNARD CORPORATION • 1817 S. HANLEY ROAD ST. LOUIS 17, MO., U.S.A.

IT FLOATS ON THE LOAD! *

You turn on the steam.

This little stainless steel valve—the only moving part in the Yarway Impulse Steam Trap installed on the equipment—opens wide and *stays* open as the air and condensate continuously pour through.

The equipment reaches production temperature in the quickest possible time.

Production temperature reached, the little valve snaps shut. After that, by a pulsating action, it discharges all condensate as it forms—even a tiny teaspoonful. *There's hot steam in the equipment all the time* . . . steady, maximum temperatures are maintained.

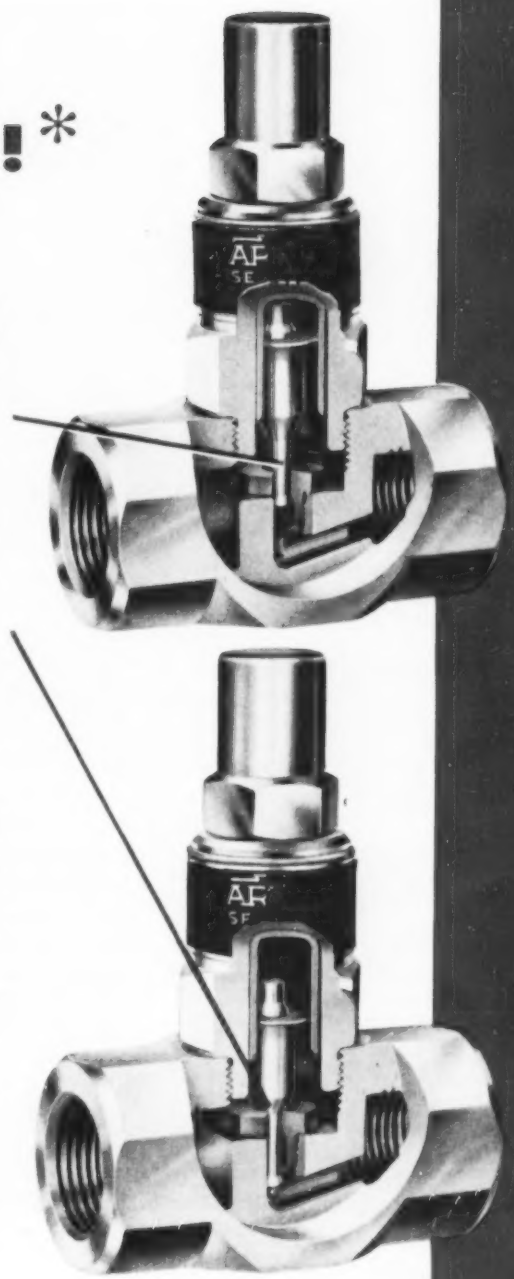
It all adds up—to more production per day.

Other profit-making features of the Yarway Impulse Steam Trap—low initial cost, easy installation, stainless steel construction, low maintenance, good for all pressures, quick delivery from over 200 local industrial distributors.

Try a Yarway—free for 60 days—and *prove* its advantage. Your distributor will supply you.

For free Yarway Impulse Steam Trap Bulletin T-1740, write . . .

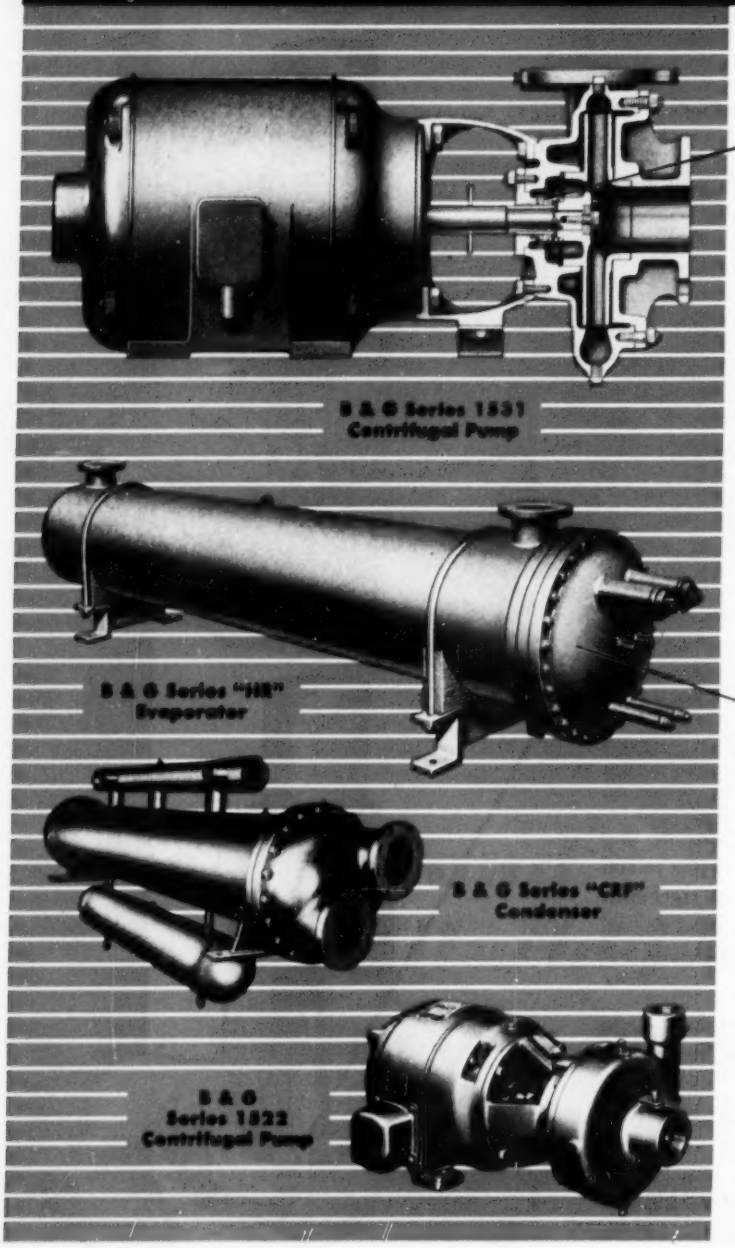
YARNALL-WARING COMPANY
107 Mermaid Ave., Philadelphia 18, Pa.

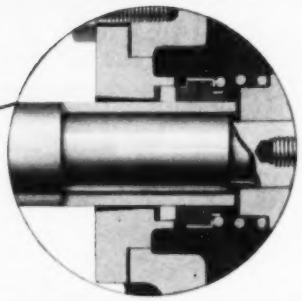


* . . . *resulting in fast heat-up of equipment, more production per day.*

YARWAY | impulse steam trap

Plus Value REFRIGERATION AND AIR CONDITIONING EQUIPMENT



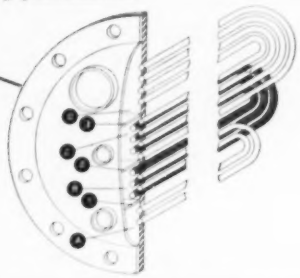


B & G 1531 UNI-BUILT PUMP WITH NEW *REMITE* SEAL

Here's a revolutionary new development in pump design...a *plus value* which eliminates leakage—assures long, trouble-free life.

A carbon seal ring faces on a "REMITE" floating seat—a new type of material, *so hard it will scratch glass*—wear-proof and corrosion-resistant. This feature alone makes the 1531 the "buy" for refrigeration and air conditioning installations.

Measure the B & G Series 1531 Pump by any standards you choose...you'll agree that never before have you seen so many warranties of top performance.



B & G SERIES "HR" EVAPORATOR

You'll find *plus value* in the unique design of this evaporator which prevents oil-trapping in the head passes. The diagram above shows how the lower tubes in each pass are located very close to the baffle plate, permitting any oil entering the passes to travel freely with the Freon vapor back to the compressor.

Other features include movable steel legs, for easy mounting under various conditions. The shell connections extend well beyond the insulation cover—assure easy installation.

Send for complete file of Catalogs

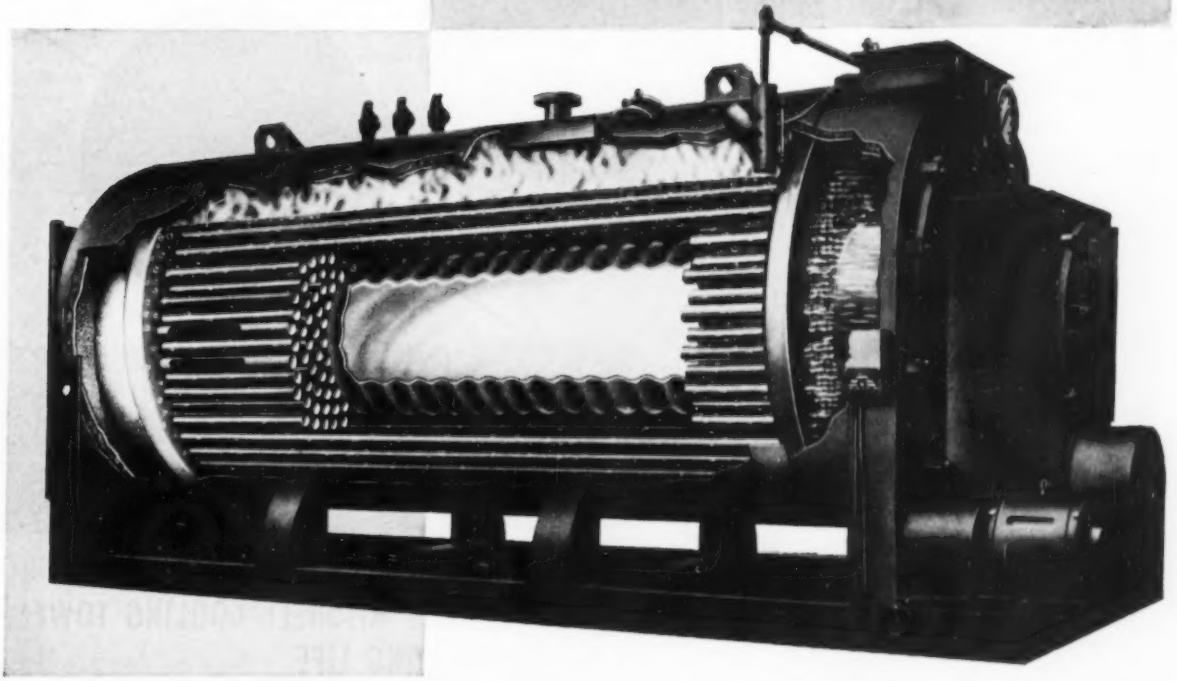
B & G Catalogs on Centrifugal Pumps, Evaporators, Condensers and Heat Exchangers give full information on the latest in air conditioning and refrigeration equipment.

BELL & GOSSETT
COMPANY

Dept. RDD-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto

Do You Know About *Continental's* Two Pass Design?



...and do you know it takes one man less than 30 MINUTES to open a CONTINENTAL BOILER for cleaning or inspection...

WITH THE CONTINENTAL, you get a self-contained, automatic steam generator, built of best quality steel, and featuring advanced two pass design. The two pass design eliminates baffles that may break during operation and cause gases to short circuit and destroy efficiency.

WITH THE CONTINENTAL, 80% efficiency is guaranteed. Also, the use of forced draft and the elimination of baffles results in uniform distribution of heat through all tubes... insuring long life because all tubes do equal work.

WITH THE CONTINENTAL, you'll hold boiler down-time to a minimum because the clean-out and inspection doors at both ends are hinged and can be easily opened by one man in less than ½ hour.

WITH THE CONTINENTAL, fuel is fired directly into the firing tube which is completely surrounded by water. There is no dutch-oven and there is *no* refractory-lining in the water-backed furnace. This gives you maximum heat transfer, complete combustion, a high CO_2 and a low stack temperature. By eliminating refractory in the furnace, heat is transmitted to the boiler water without being stored and wasted in heating a refractory firebox . . . Steam with less than ½ of 1% moisture is assured in high pressure boilers, and less than 1% moisture in low pressure boilers.

WITH THE CONTINENTAL, you save on fuel (U. S. and foreign patents pending on exclusive firing method). The *oil burner* uses a pressure atomizing nozzle which is easy to service—has no cups or moving parts to wear out. The *gas burner*—rather than premixing—mixes fuel and air at the point of ignition, producing a uniform, highly radiant flame.

WITH THE CONTINENTAL, you get a boiler which, before shipment, is test fired and adjusted for maximum performance. No special stack or foundation required.

Continental Boilers, for high or low pressure, oil or gas fired—or combination thereof, range from 20 to 500 hp. Write for catalog 102.

CONTINENTAL is sold, installed and serviced by competent distributors throughout the U.S.

BOILER ENGINEERING AND SUPPLY COMPANY, INC.
8 Manavon Street • Phoenixville, Pa.
40 Years of Boiler Experience

LOOK WHAT'S HAPPENING IN YOUR COOLING TOWER

HERE'S WHY KOPPERS PRESSURE CREOSOTING ON HALSTEAD & MITCHELL COOLING TOWERS IS VITAL FOR LONG LIFE

WHY CREOSOTED WOOD?

Rough-cut wood simply "wets" more effectively than any other suitable material. Constantly wetted wood is subject to immediate attack by fungus and marine parasites. Creosote is the most permanent and positive preservative for timber . . . *containing 162 elements* toxic to fungus growth and parasites . . . proved by over 100 years of use. All wood used in Halstead & Mitchell Cooling Towers is pressure-creosoted.

WHY KOPPERS PRESSURE-CREOSOTING?

Wood preservatives must penetrate deeply to be effective; a surface coating can be worn or broken through and the wood is then under immediate attack. Koppers Pressure-Creosoting gives the deepest possible penetration and longest possible life. Therefore, Halstead & Mitchell wetted decks are Koppers Pressure-Creosoted.

ONLY HALSTEAD & MITCHELL OFFERS THE

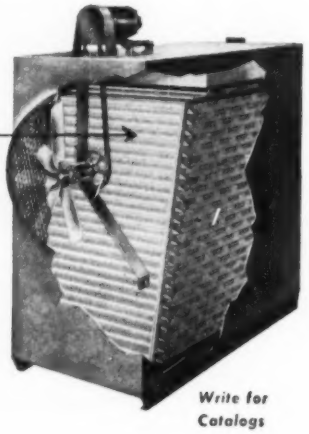
20-Year Guarantee!

ON THE WETTED DECK SURFACE

against rotting by fungus attack

2 thru 100 Tons

Sheet-Steel Cabinets,
3-times protected
Stainless Steel Fans and Shafts
Weather Shielding
Gravity-Type Distributing Pans
—no windage loss
Everdur Bolts for ease of
disassembly at any time.



Write for Catalogs

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Halstead & Mitchell

OFFICES: Bessemer Bldg., Pittsburgh 22, Pa.

What's Your Problem— EXCESSIVE INVENTORY?

Deal with

DETROIT!

One Compact Yet Complete Line Answers Every Service Need!

How would you like to reduce inventory? Simplify ordering? Ease stocking and handling? Obviously, you would . . . *and you can* without reducing your ability to fill orders one iota! How? By simply following the lead of thousands of leading wholesalers and dealers who have answered these and other problems with DETROIT Controls. For with DETROIT Controls you handle one compact yet complete line that answers every heating need. That's because all DETROIT Controls, built by men who know your business, understand your problems, are designed for maximum adaptability and flexibility. DETROIT'S remarkable *Timed Cycling* Thermostat, for example, with its exclusive parallel heater gives you *one* thermostat for *all* jobs. As a result there is no choosing from a large assortment of heaters—no adjusting of variable resistors. In addition, all DETROIT Controls are quality-built of top quality materials to assure long, continuous trouble-free operation. But why not find out for yourself? For complete information concerning the superior DETROIT line contact your nearest DETROIT wholesaler or write the factory direct.

Do You Know the DETROIT V-579 "BI-FLEX" GAS VALVE STORY?

Here is an absolutely quiet valve which is not only designed to function with natural, L.P., or sour gases, but also to function independently of gas pressure. Performance proven on thousands of installations this snap-acting, positive closing, "Bi-flex" motor-actuated valve is famous for its reliable operation. Rugged and compact design makes it easy to install and service . . . compensated for changes in ambient temperature . . . ½" to 1¼" sizes.

DETROIT Controls CORPORATION

ESTABLISHED AS DETROIT LUBRICATOR COMPANY IN 1877

5900 TRUMBULL AVE. • DETROIT 8, MICHIGAN Division of American Radiator & Standard Sanitary Corporation

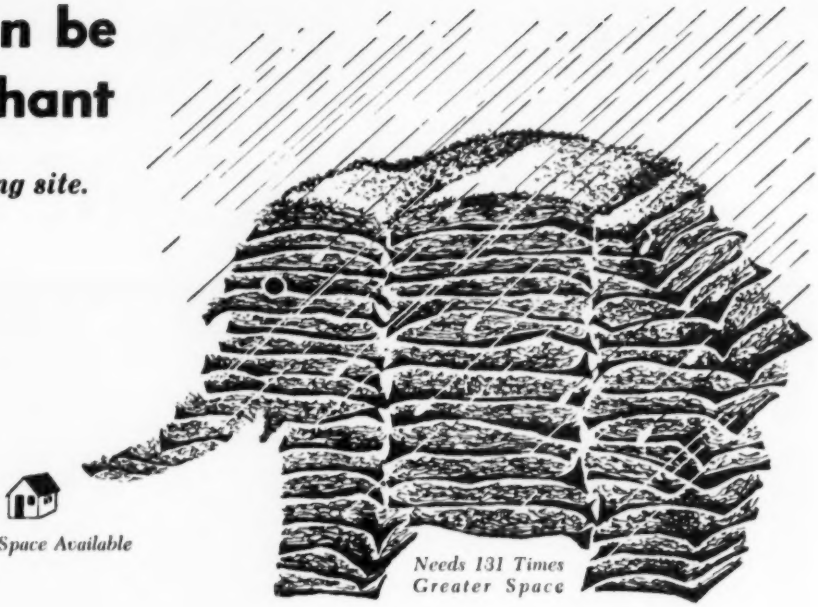
Representatives in Principal Cities • Canadian Representatives in Montreal, Toronto, Winnipeg—Railway & Engineering Specialties, Ltd.

AUTOMATIC CONTROLS *for* REFRIGERATION • AIR CONDITIONING • DOMESTIC HEATING • AVIATION TRANSPORTATION • HOME APPLIANCES • INDUSTRIAL USES

Serving home and industry—AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

Insulation can be a White Elephant

It can clutter up a building site.
And if it rains before
the building's up . . . !



STORAGE SPACE at building sites, even outdoors, is so scanty, that bulky ordinary insulations are often left exposed to the weather, even to rain, before and during installation. Soon they are sopping wet.

Pilferage and where to put other materials become pressing problems. Ordinary insulation, packaged, occupies 131 times as much cubic space as equivalent multiple aluminum. Two under-the-arm cartons of multiple accordion aluminum insulate the average dwelling (providing 2000 sq. ft.); can be toted to the job on a bus; offer no storage problem. They are easily stowed in a tool bin or in a car; an auto will carry 20,000 sq. ft.

Moisture destroys insulation values. Water in the interstices of a material is an excellent heat conductor. Standard thermal factors for insulations refer only to a BONE-DRY condition. Excessive moisture causes peeling paint, crumbling plaster, rotting wood.

Excessive condensation is sometimes produced inside building wall and roof spaces because of excessive passage of water vapor from the warm side of ceiling or wall space to the colder surface, where it condenses.

The metal sheets of multiple accordion aluminum are impervious to water vapor, and are continuous. Infiltration under the flat, stapled flanges is slight. The scientific construction of multiple layers of accordion aluminum, fiber and air spaces minimizes condensation on or within this type of insulation. Its slight mass is capable of little heat storage.

Improved* multiple accordion aluminum, Infra Types 6-S*i* and 4-S*i*, gives every fraction of the area between joists maximum protection against heat loss and condensation formation.

A U.S. NATIONAL BUREAU OF STANDARDS report, "Moisture Condensation in Building Walls," may be had from us. It explains how condensation takes place in walls, insulated and uninsulated, and discusses means of prevention.

COST OF INFRA INSULATION INSTALLED
in new construction between wood joists, material with labor,

Type 6-Si under 9½¢ sq. ft.
Type 4-Si under 7½¢ sq. ft.
Type 4-S Jr. under 7½¢ sq. ft.

INFRA INSULATION, Inc., 525 Broadway, New York

*U.S. Patent applied for

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THE EDITORS' PAGES

TO EARN THE RIGHT to display the Audit Bureau of Circulations insigne shown each month on HPAC's contents page, we have joined with more than 2500 other publications, with many of the companies who talk to you through advertising in our pages, and with the professional advertising agencies who prepare their messages, to set firm, well-understood rules through mutual agreement for the important intangible commodity called circulation. . . . . The ABC audit proves you pay to read what HPAC has to say. It also shows us when we cease to serve you effectively. This constant check of your interest keeps us on our editorial toes.

Construction Estimates at Record Levels

EXPENDITURES FOR new construction continued at record levels in August, totaling slightly over $3.3 billion, according to preliminary estimates of the building materials division of the U. S. Department of Commerce and the U. S. Labor Department's bureau of labor statistics. Dollar volume was about 7 percent above the total for August 1952.

The July-August increase was somewhat less than expected, largely because of a drop in private housing. Dollar outlays for private residential construction declined for the second successive time in August, reflecting a downtrend in housing starts during the preceding three months.

Commercial building, continuing the sharp upward movement of the past several months, rose considerably more than seasonally. Private spending on industrial building leveled off, after having declined steadily since early spring. Gains in roadbuilding and in privately owned public utilities were about seasonal. Expenditures for military and naval facilities and for public industrial plant remained unchanged from July.

Private expenditures totaled $2.2 billion, and public, $1.1 billion. Both amounts were slightly above the July totals.

Expenditures for new construction this year are expected to reach $34 2/3 billion, exceeding last year's record by 6 percent, according to estimates prepared jointly by the building materials division and the bureau of labor statistics. This year's dollar volume of new construction also will represent a new peak in work actually put in place, when adjustment is made for price changes.

The continuation of the steady postwar climb in construction activity into 1953 will result primarily from a sharp rise in commercial building, substantial increases in expenditures for privately-owned public utility construction, private housing, schools, and highway work. The only major types of construction for which expenditures are expected to decline are private industrial construction and farm and hospital building.

The rate of increase over 1952 will probably decline moderately in the second half of the year, reflecting a smaller rise for the last six months than is usual, as outlays for private plant decline steadily, and expenditures for private housing and military facilities taper off.

$10 Million Expansion for Air Conditioning Firm

A $10 MILLION expansion program involving the construction of a new plant in the South and extensive additions to present facilities in Syracuse, N.Y., was announced last month by Cloud Wampler, president of Carrier Corp., leading manufacturer of air conditioning equipment. The building of the southern plant is the first step in a long-term program that calls for other facilities that will bring production closer to major markets, he said.

The proposed southern plant will cost in the neighborhood of $5 million, will be devoted to the manufacture of so-called unitary products, such as room air conditioners, year 'round residential air conditioning equipment and self-contained units for use mainly in relatively small commercial establishments. The addition to the Syracuse facilities will include office, laboratory, warehouse and storage space. The new buildings will be constructed adjacent to the existing main plants of the corporation and will serve to increase substantially the production of unitary equipment.

Carrier booked new orders during the 12 months ended July 31, 1953, in excess of $171 million. This is an all-time record for the corporation. Bookings for the preceding 12 months were approximately $94 million. Neither of these figures reflect the unshipped portions of special defense contracts.

Completed sales also set a new high record. For the 12 months ended July 31, 1953, these were almost $154 million. The total for the comparable 1952 period was approximately $103 million. The current backlog of unfilled orders of all types amounts to approximately $137 million as compared with $95 million a year earlier.

Air Conditioning Increases Church Attendance

INCREASES AS HIGH as 50 percent in church attendance and collections are attributed to air conditioning, according to a recent survey reported in Architectural Forum.

Over 5 percent of all U.S. churches with seats for more than 100 persons have installed cooling systems, most since 1950 and mostly in the southern states, according to the survey. About 3 percent of these churches have "refrigerated air conditioning."

British Engineers Present "Loyal Address"

A "LOYAL ADDRESS" on behalf of the members of the Institution of Heating and Ventilating Engineers, London, was presented to Queen Elizabeth on the occasion of her coronation. It is inscribed on vellum, illuminated in color and has gold leaf initial letters.

One part of the address reads: "We are pleased to feel that our work is devoted to increasing the health and comfort of Your Majesty's subjects, both in this country and overseas, and we receive inspiration and

encouragement from the very great interest which His Royal Highness The Duke of Edinburgh takes in the science and practise of engineering."

Award Mechanical Contracts for Chicago Building

VENTILATION WORK in the completely air conditioned Prudential Insurance Co. of America building now under construction in Chicago will be done by R. B. Hayward Co. and Jamar-Olmen Co. as a "joint venture," it was announced last month.

William A. Pope Co. will install the air conditioning refrigeration, and M. J. Corboy Corp. has the contract for the sprinkler piping and the plumbing. Naess and Murphy are the architects and engineers and the George A. Fuller Co. is the general contractor.

As has already been reported in HPAC, the Prudential building is the first big downtown office building for Chicago to be built since the early 1930's, and one of the first of the city's big buildings to be completely air conditioned—although existing structures, such as the Edison and Marquette and the Standard Oil buildings, have been air conditioned.

Boilers Provide Steam for Heating, Cooling

TWO PACKAGE UNIT steam boilers in the sub-basement will provide steam for refrigeration for air conditioning in the summer and for heating in winter at 99 Park Ave., New York's first aluminum-faced office building. Each of the boilers is rated at 22,425 lb per hr of steam.

The 26 story building, built and owned by the Tishman Realty & Construction Co., is scheduled for occupancy this year.

Plans Use of Titanium in Valves and Fittings

THE NEW $25 million titanium plant of Cramet, Inc. — wholly owned subsidiary of Crane Co. — in Tennessee will increase titanium sponge production by 6000 tons annually. It is scheduled for partial production in 1954 and full production a year later, and will include facilities for the production of ingots of titanium and titanium alloys, as well as sponge, the almost pure material from which titanium is made.

A large part of the initial output of titanium from this plant will be channeled directly and indirectly toward Air Force requirements. When supplies will permit, use of titanium in valves and fittings for highly corrosive conditions is seen.

Design Proficiency Key To Building Conservation

THE BUILDING RESEARCH Advisory Board has issued Part 2 of its Study of Conservation in Building Construction, in the form of a report to the Office of Defense Mobilization. A 30 page summary of the report is available from the BRAB, 2101 Constitution Ave., Washington 25, D.C., and a very limited number of copies of the original report are available for sale by the BRAB.

The section of the report on heating, ventilating and air conditioning is summarized as follows:

An advisory panel of specialists in heating, ventilating and air conditioning made recommendations intended to draw attention to improvement in design standards and practices as measures for conservation. Engineering judgment was stressed as a major factor in achieving conservation in design. The panel also pointed out "that conservation is dependent on new ideas and improvements in existing standards and practices."

The recommendations — addressed to the American Society of Heating and Ventilating Engineers and other technical organizations with specialized interests — dealt largely with heating systems as used in federal construction. They covered a range through weather data, heating and cooling loads, infiltration, heat-holding capacities, high temperature systems, pipe corrosion, steel boilers and boiler ratings, fan noise ratings, summer design data, and cooling storage effect.

A group of technical advisers stated that "design proficiency is the key to conservation in building construction" and "conservation in building design is dependent on the ability of the individual designer."

The Building Research Advisory Board recommends that the government make possible the development of a climatological atlas by the United States Weather Bureau. The BRAB further recommends that organizations in the building industry who see value and usefulness for a climatological atlas should aid and assist the Weather Bureau with statements of the nature of the data and information desired and with statements of the value of such an atlas to them. The board invites organizations who wish to further the development of a climatological atlas to collaborate with the BRAB climatic research committee.

"Quote"

"This is the last summer we're going to try to get along without air conditioning."—*John Q. Public, during last summer's heat waves.*

Air Conditioning Sets Power Use Peaks

THE WIDESPREAD and increasing use of air conditioning is responsible for new record highs in electrical consumption.

New peaks in electricity output were established last summer during the nationwide heat waves. Such increases tend to offset declines in industrial demands for power due to vacation periods. Summer outputs in many places now exceed winter peaks, because of air conditioning.

"Revolution" in Weather Subject of New Book

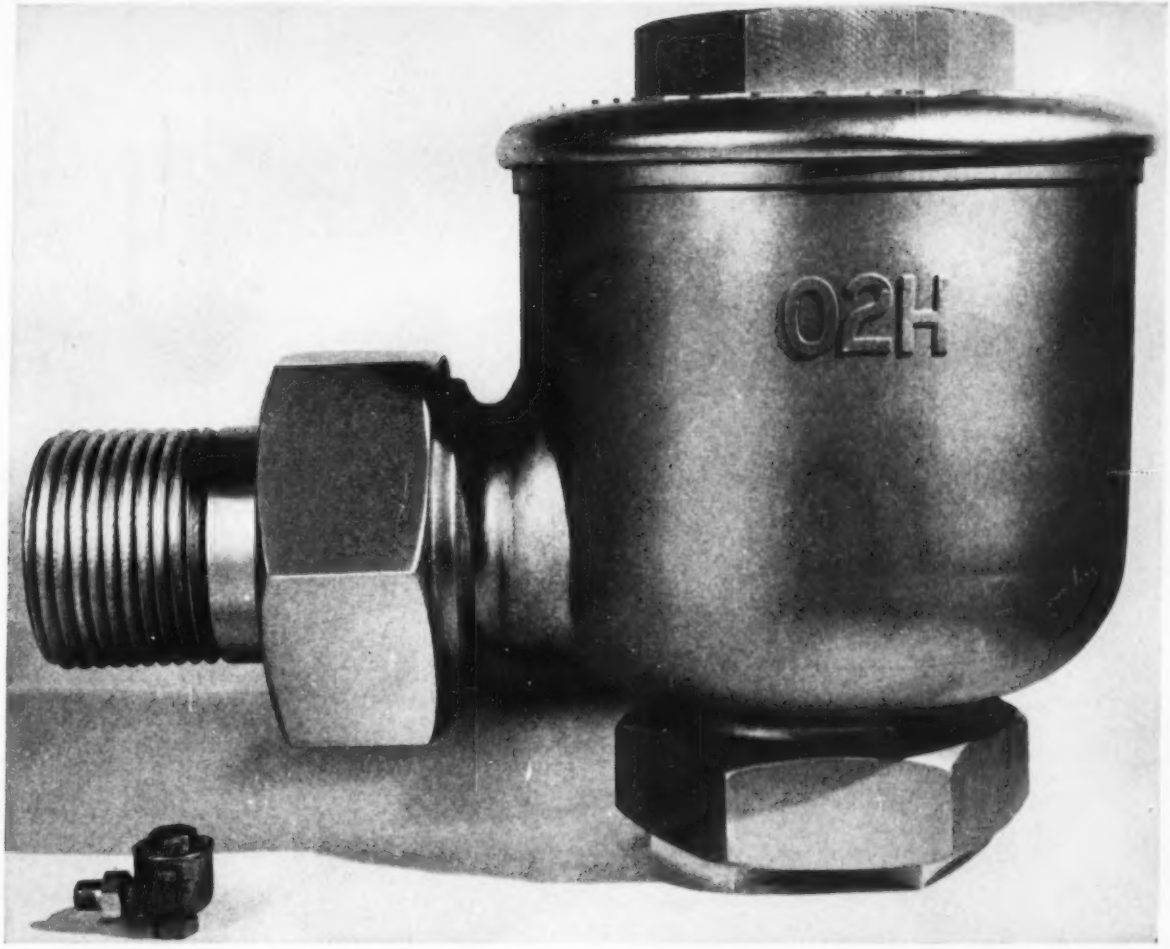
THE TEMPERATE zone is moving northward, affecting future economic life all over the world and the center of industrial power, according to a new book by William J. Baxter, Today's Revolution in Weather.

One theory the author advances is that increased carbon dioxide in the atmosphere is at least partly responsible by preventing the radiation of heat from the earth.

Dean Arthur M. Greene, Jr., of Princeton, Dies

ARTHUR M. GREENE, JR., dean emeritus of Princeton University's school of engineering and one of the country's best known figures in the field of mechanical engineering, died last month at the age of 81.

Dean Greene was a prolific writer on technical subjects and was the author of a number of works, including the books, Elements of Heating and Ventilation and Elements of Refrigeration.



. . . a small Trap — but BIG in performance

It works all the time . . . automatically . . . discharging air and water of condensation . . . holding steam in radiators or steam-using equipment until it has given up its useful heat. It's a servant that never sleeps. It's your Webster Radiator Trap.

You can hold it in the palm of your hand. It's comparatively small in size, but big in performance. Shown at lower left above is an actual Webster Trap. Shown next to it is a giant model of this same trap . . . illustrating how the savings from one Webster Trap multiplied 109, 500 or 1,000 times play a vitally important role in fuel conservation.

Webster Traps, like all Webster steam heating specialties, give years of trouble-free service. Materials are selected for ability to withstand severe service. Parts are inspected after each manufacturing operation. No item leaves the factory until it has proved that it will function properly.

See your Webster Representative for complete data on Webster Radiator Traps, Radiator Valves, Float and Thermostatic Traps, Dirt Strainers . . . for low pressure vapor and vacuum steam heating service.

Address Dept. HP-10

WARREN WEBSTER & CO.
Camden 5, N. J. Reps. in Principal U. S. Cities
In Canada, Darling Brothers, Limited, Montreal

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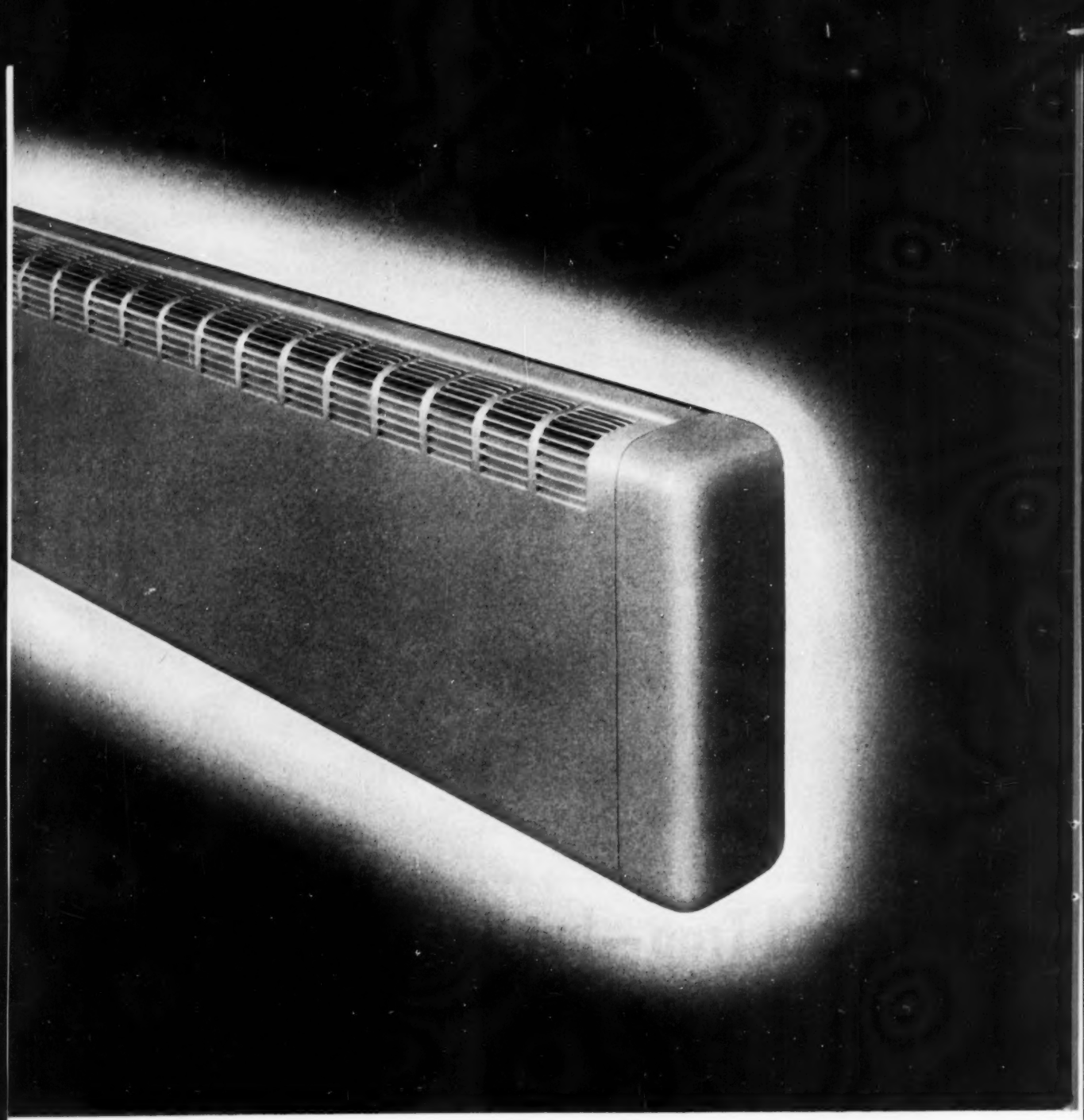

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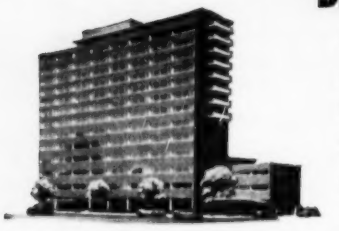

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"OPEN FOR DISCUSSION"

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P. A. HYDE —

"Really Interesting Series of Articles"

ONE OF THE really interesting series of articles currently running in HPAC is the group by Bill Dopp published under the title, Anything Can Happen. I would like to know if a dozen reprints of the one in the August issue, How Do You Know Valve Is Closed?, are available.

All of the mechanics under my supervision are operating valves of all sizes from 1 in. to 15 in., carrying approximately 135 psi steam. I am sure I could get some very lively discussion from all of them by first asking the question and then presenting the article.

I also enjoyed the articles by John F. Collins, Jr., in the August and September issues, on the National District Heating Association's meeting. To me, it was one of the most interesting sessions the NDHA has had in a long time. Certainly, no association has ever had a finer group of officers coming up through the line, starting with Charlie Deeg as president for this year.—P. A. HYDE, Supervisor — Steam Sales and Distribution, Akron Div., Ohio Edison Co. (Note: Mr. Hyde is a past national president of the NDHA.)

WM. O. HUEBNER —

"There Shouldn't Be Any 'Deluxe' Installations"

F. F. STEVENSON's fine articles on the air conditioning of TV stations recently published in HPAC, are required reading for everybody concerned with the practical needs of television air conditioning, and of great interest to architects, contractors and air conditioning engineers generally.

Mr. Stevenson, in his introduction, commented on the fact that most TV plants are still located in big office buildings or similar structures, and that very few TV stations are located in buildings which were especially built for them. I would like to discuss this point.

Television started in New York, because New York — with its prospective audience of millions — is the home base of many national advertisers. New York had to be the proving ground of television also on account of the physical, technical and monetary restrictions of early television, not to mention the restrictions imposed by the Federal Communications Commission. However, there were no television studios in New York, and early television did not start in TV studios that were intended as studios but in radio studios, theaters, warehouses and other buildings.

To discuss the difference between television and radio, and how this affects air conditioning, is beyond the scope of this short note, but it is helpful to recall that a building ideally suited to radio work need by no means always be equally well suited to television work. As pointed out by Fortune magazine some time ago, television requires much more complex technical equipment than radio work, requires a host of performers and production personnel, and does not fit the Radio City ideal of Rockefeller Center — studios and offices piled vertically — because television is horizontal, not vertical. The magazine went so far as to say that in using unsuited buildings for television "millions of dollars were spent on structures that were obsolete before they were complete."

We may not agree with this statement, but there is no doubt that many of the early shortcomings of television stations, including their air conditioning, were directly related to the fact that television started in buildings which had not been built with the needs of television in mind. Therefore, it will be an easier — and more satisfactory — task to air condition structures especially designed for television.

I want to raise a second point — namely, the difference in the relative amount of money to be spent in air conditioning bigger and smaller stations. According to Mr. Stevenson, "stations in the first classification may be assumed to have high and critical air conditioning standards; they will want the best, and be willing to pay for it. . . . The second class of stations probably will not require such elaborate air conditioning installations; many of them will definitely limit the money to be spent." Therefore, Mr. Stevenson says, "the designer will have to use his ingenuity to provide a common meeting ground for technical requirements and the pocket book."

I quite agree with Mr. Stevenson, so far as the *actual* difference in air conditioning big and small stations is concerned. However, I dissent, if it comes to air conditioning standards. In this respect, the air conditioning of television stations does not really differ from any other commercial or industrial use of air conditioning, and it seems wrong to me to assume that the small company has more reason to be careful with its money than its big competitor. To operate a television station — even a small one — is no shoe-string affair, and good air conditioning is imperative for the small station as well as for a television city.

Air conditioning has now reached a stage where we should avoid differentiating between the "deluxe application" and the "normal application". I use the word "deluxe" advisedly (though Mr. Stevenson did not use it), because I see with regret that it has even found its way into the technical data section of the ASHVE's Guide. To be sure, *every* air conditioning installation should be economical, and the designer should have the customer's best interest at heart in selecting equipment. However, he should apply the same standards to all stations, whatever their size. He should not look too much at first cost, because we all know that the money spent on good equipment is well spent.

Mr. Stevenson's instructive discussion of the solar load will, I hope, induce the younger members of the profession to study the tables

for calculating solar heat gains through walls and roofs which some years ago were included in the Guide.

The American Society of Heating and Ventilating Engineers has been very active in recent years in increasing our knowledge of solar radiation and radiation through glass by analysis as well as by experiment, and it pays to consult the Guide on these matters, or sometimes to refer to the original papers by Professors Mackey and Wright, by Mr. Stewart of Carrier Corp., and by Messrs. Parmelee and Aubele of the ASHVE Research Laboratory. The enlightening papers on Heat Gains are Not Cooling Loads (ASHVE Transactions 1949, p. 413 and HPAC, August 1949, p. 105); Effective Heat and Heat Loss Calculations (HPAC, December 1951, p. 94 and January 1952, p. 130); and Cooling Load from Sunlit Glass (HPAC, August 1952, p. 117) by Professors Mackey and Gay also deserve careful study in connection with this subject.—WM. O. HUEBNER, Anemostat Corp. of America.

THEODORE E. STEPAN —

"Valuable Data on Church Air Conditioning"

THE ARTICLE ON ICE storage air conditioning, by J. A. Wilkerson, published in the June HPAC, provides valuable information on the design of systems for high demand, short time loads and will be appreciated by many engineers who are concerned with air conditioning buildings such as churches where the initial cost and operating cost must be kept low.

The author states that one of the safety factors in the design of the system is the use of the 4:00 p.m. maximum sun effect. I do not believe that this is the correct basis for the design of air conditioning systems for churches. It would be better to base the design on the actual temperatures occurring at the time the load develops. The evening load for a church will certainly be different from the morning load. Except for weddings and funerals, which are infrequent, there is usually no afternoon load. In connection with the morning load for churches, I have never found any reference in the literature to the desirability of using design temperatures lower than those commonly used for ordinary applications. During the summer of 1952 I made some observations to determine the change in temperature during the day. The data indicated that for the church service ending around 12 noon, the design temperature could safely be 90 F in this latitude (Vicksburg, Miss.) instead of 95 F. Of course, a complete analysis of the loads should be made if the entire church is air conditioned.

With reference to the calculations for the circulating pump, the motor efficiency should not be included in the formula for the pump horsepower; however it does affect the energy consumption by the motor. I believe that it would be better to determine the pump efficiency from the manufacturer's data and use the formula hp = gpm $\times$ head $\div$ 3960 $\times$ pump efficiency. In the example given it appears that the head is about 54 ft. The efficiency of such a pump should be about 80 percent; therefore, a 10 hp motor would be sufficient with a consequent saving in cost of motor, starter and operation.—THEODORE E. STEPAN, Mechanical Engineer.

THE AUTHOR REPLIES —

IN CALCULATING A church load using a latent storage system, it is well to remember that in the majority of cases the building will not be used on successive days. Because of this there is a gradual build up of heat within the building. This is particularly true of churches which are usually somewhat massive in construction. Because of this, when the air conditioning is turned on, the air in the structure must be cooled and also the walls, pews and all other parts of the building as well.

It has been found through experience that this load may be greater than any regularly calculated load on a conventional, steadily used building. Temperatures as high as 95 deg have been observed inside a church building at 7 a.m. To offset this load an arbitrary method may be used in figuring maximum sun load and the maximum amount of people as occurring at the same time.

It is realized that this does not occur but it seems to work out well as a means of securing the proper equipment to take care of this high early peak.

In structures where it is feasible, it is good practice to install a large ventilating fan to introduce large quantities of outdoor air during the night to remove as much of the stored heat as possible with the cooler night air. In existing structures this is not too often possible and therefore the peak must be taken care of with the air conditioning plant.

Regarding pump selection, in order to correlate the factor used in Fig. 1 of my article, namely, 2000, the pump formula would have to be based on a 50 percent efficiency.

Assuming a 50 percent efficient pump pumping against an assumed 50 ft head, the following formula may be used:

(560 gpm times 50 ft head) divided by (3960 times 50 percent pump efficiency) equals 14.1 horsepower

From this it can be seen that a 15 hp motor would be ample in size.

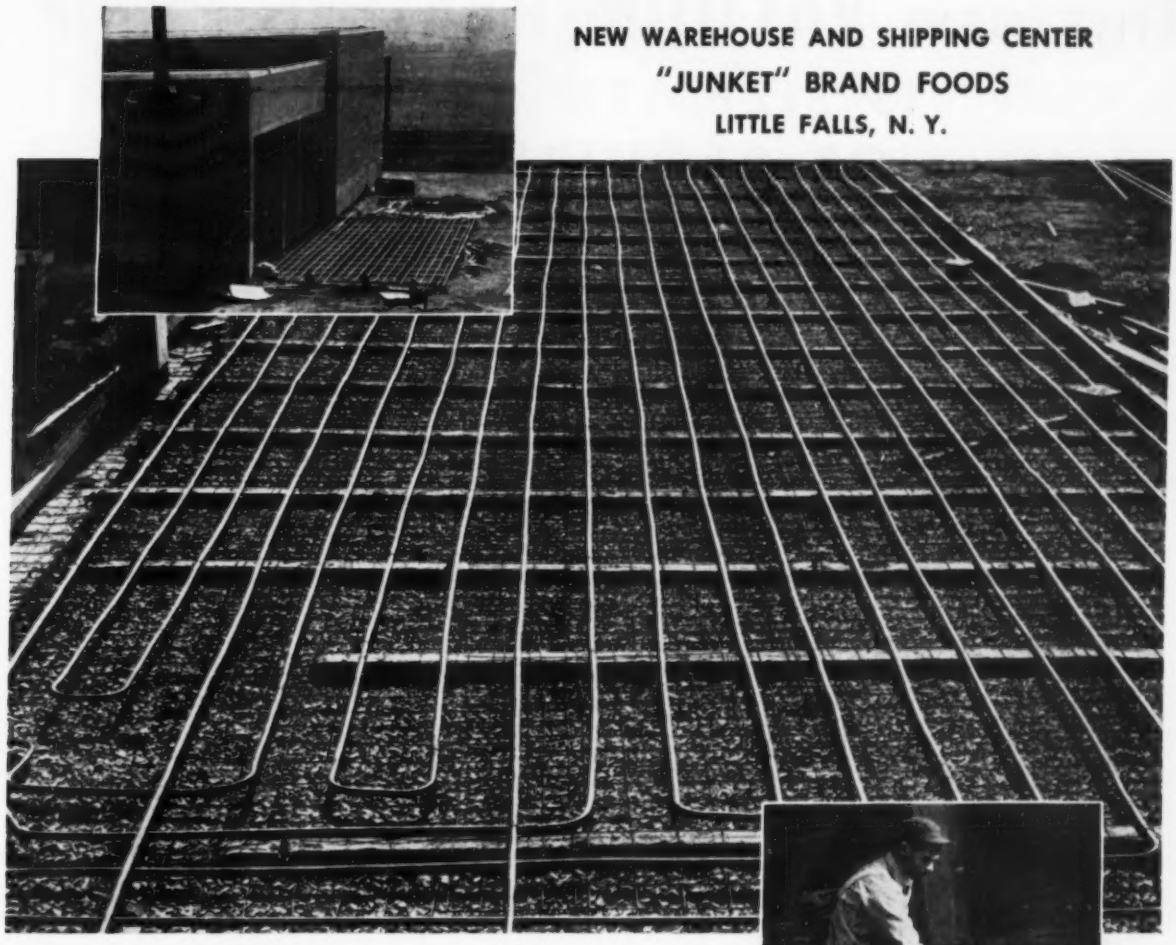
Should the pump manufacturer's information indicate an 80 percent efficient pump, the hp could be calculated by applying this figure to the above formula which would give 8.8 hp, indicating a 10 hp motor could be selected.—J. A. WILKERSON, Dole Refrigerating Co.

RALPH STOETZEL —

"Listen to Your Heating Engineer"

I HAVE READ with interest the Sam Lewis' Page, Basementless Buildings Pose Practical Heating Problems, published in the August HPAC, and I would like to comment:

Basementless buildings have been with us for a long time and they will stay with us. We are just beginning to know how to use them with the various modern means of heating that are now available. Methods of keeping out dampness, of adding warmth, cleanliness and strength are now demanded. All these are available within reasonable budget allowances. The use of basementless buildings is like many other old usages in present favor. Their success in modern usage is because of modern facilities. Trenches, tunnels, base burners and wood stoves must be left behind by the proper use of thermostats, unit heaters, pumps and pressure systems. The successful use of any building depends on the proper use of the correct modern facilities. "Listen to your heating engineer when you have heating problems" is good advice.—RALPH STOETZEL, Architect.



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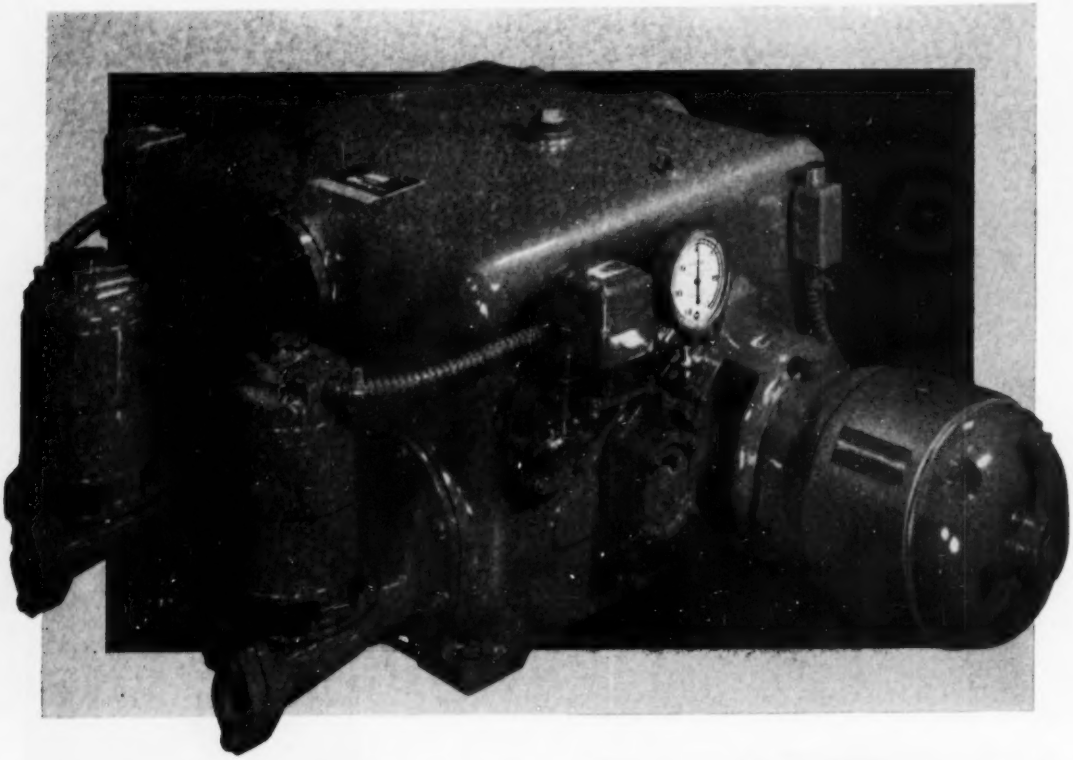

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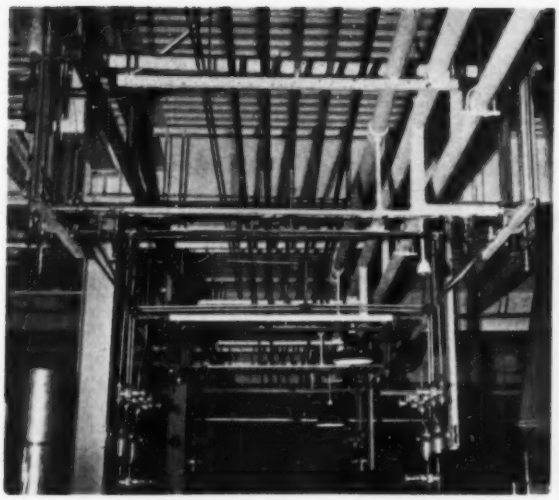
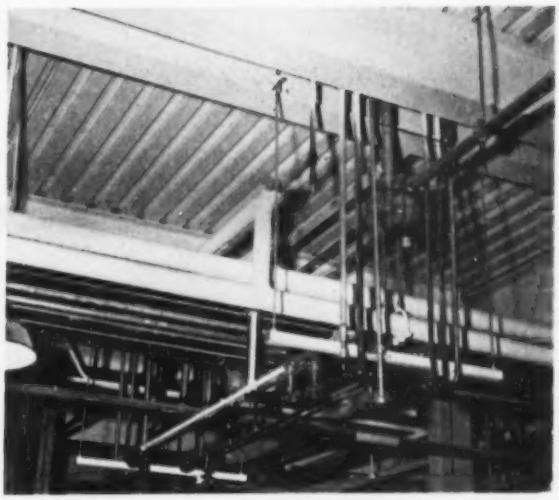




1 Laboratory service piping in basement. Mains are run directly under the corridor serving the laboratories on the floor above. Branch cut-out valves are located close to the mains and branches are extended upward through floor and into double partition between corridor and laboratory rooms on both sides of corridor

How To Do It —

Piping Radiological Labs

By W. W. McIntosh
Mechanical Engineer
General Electric Co.
Richland, Wash.

INDUSTRIAL AND research laboratories require many different piping services, which must be planned and installed to facilitate future changes. Laboratories in which radioactive work is performed present such additional problems as the detection of and removal of radioactive contamination — always a serious potential health hazard.

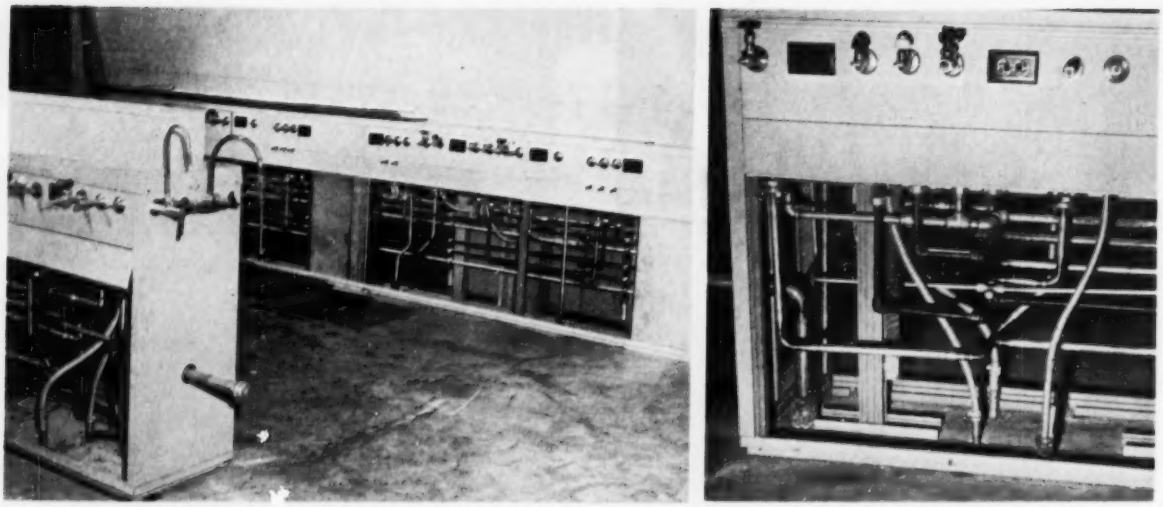
A SURPRISING number of different services are used in a modern industrial or research laboratory. Twenty or more independent piping systems may be installed to make available to the laboratory worker the wide variety of gases, reagents, different qualities of water, vacuum services and waste disposal systems that may be needed to carry on his work.

Laboratory buildings are usually built as permanent structures. But industrial programs are constantly changing, and the requirements of the industrial laboratory undergo corresponding changes. Too, research is continually venturing onto unexplored ground — so it is virtually impossible to anticipate fully the future needs of the research laboratory.

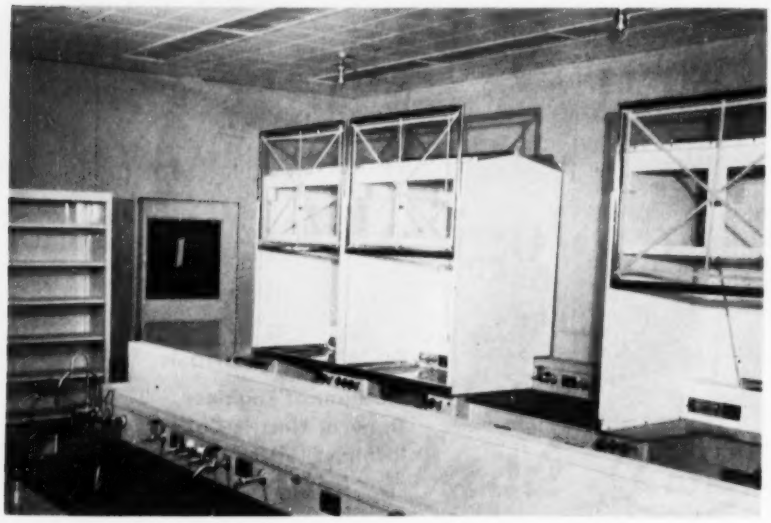
Thus, it is necessary to provide flexibility in the piping arrangements for both types of laboratories. Materials are chosen with a view toward their usability for a variety of services, and spare lines and space for additional lines are made available so that laboratory work may be adapted readily to changing requirements. The design of laboratory piping is strongly influenced by these considerations.

Radiological Problems

Laboratories in which radioactive work is to be performed are designed with a number of other requirements in mind as well. One of the routine problems in such work is detecting and removing radioactive contamination, which must always be regarded as a serious potential health hazard. Radiological laboratory design takes this into account. Interior finishes for walls and floors are chosen for their decontaminability; that is, for absence of inaccessible cracks, cor-



2 Piping in laboratory rooms shown before completing installation of decontaminable wall panels



3 Piping installation in laboratory room after decontaminable partition installation is complete and hoods and furniture have been put in place

4 Laboratory service piping in tunnel directly under corridor serving laboratories on floor above. Branch lines extend upward through floor into double partition between corridor and laboratory rooms

ners and pockets, for their nonporous surfaces and for their ability to stand up under decontaminating procedures (which may include acid and solvent washes.) An extension of this philosophy of careful selection of interior surfaces is the elimination of all surfaces which are relatively inaccessible and which would be difficult to clean. Since large numbers of exposed pipes would present a difficult problem in decontamination, the elimination of open-work piping is carried out to the greatest extent possible. Figs. 2 and 3 show the manner in which piping may be concealed behind removable, decontaminable partitions with only the service terminals visible.

Maintenance is always a problem in piping systems. Laboratory services, which include corrosive materials, are particularly subject to the need for maintenance. The radiological laboratory presents the further problem of maintaining piping which may be contaminated with radioactive material.

Work on piping in this condition is particularly difficult in confined spaces. The repairman must be protected by constant monitoring of the radioactivity with detecting instruments, and he may need to wear protective clothing — including, possibly, a breathing mask. In extreme cases, involving high levels of radioactivity, temporary shielding with lead bricks or other material may be required, and the work must be done from behind the shield using specially designed tools. These

things must be kept in mind when laying out piping in which radioactive materials may be carried.

In addition to the considerations of decontaminability and accessibility for maintenance, there must be added all the usual requirements which enter into the design of piping systems, such as space allowance in the building with minimum interference to access and functions which will be performed therein, sectionalizing of each system to permit isolation of reasonably small segments, physical support of the piping, and ventilation and lighting of the pipeways.

Planning the Piping

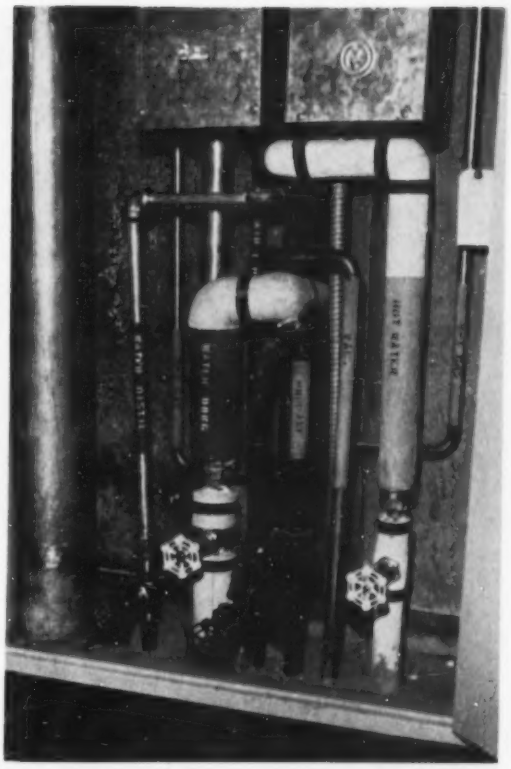
The practical solution of the problem of where to locate the pipeways depends on so many variables that no particular answer stands out as an example to use as a universal guide. In many cases it appears that an efficient piping arrangement can follow the layout which is chosen for the exhaust ventilation system. Since ventilation takes so much room anyway, and since access, lighting and ventilation must be provided for spaces in which potentially radioactive ventilation exhaust systems are located, it follows that, with little additional room, the same space can serve for the installation of piping and electrical facilities.

Thus, with arrangements in which the exhaust is taken downward from hoods and equipment, it is often economical to provide piping services from below; and in arrangements where exhaust is taken upward from the equipment, the preferred location of electrical and piping facilities may be above. There is, of course, the remaining alternative of bringing the services into the laboratories from adjoining service corridors on the same level. This arrangement can be combined effectively with an updraft ventilation exhaust system in which the ducts are run above a suspended ceiling in the laboratory room area into the utility corridor.

Fig. 1 illustrates a piping arrangement in which the service distribution mains are on the floor below, directly under the laboratory access corridors. The branches extend upward into the space between the corridor partition liner and the laboratory room liner. The piping then extends laterally into the walls separating adjacent laboratories, or into the half-height partition peninsulas within laboratory rooms to serve the hoods and work tables located thereon, as shown in Figs. 2 and 3. In this arrangement the mains and the cut-out valves are located in a full basement, with the branch lines running upward.

Fig. 4 shows the mains in a pipe tunnel and Fig. 5 shows the access panel on the floor above in the corridor wall, from which the branch cut-out valves may be reached.

Fig. 6 shows piping and ventilation services in a service corridor. This corridor serves to carry the mains from which branches run horizontally to fixtures, as described above, and in addition to the service corridor directly above and thence to the fixtures on that floor.



5 Branch line cut-out valves located behind access doors in double partition between corridor and laboratory

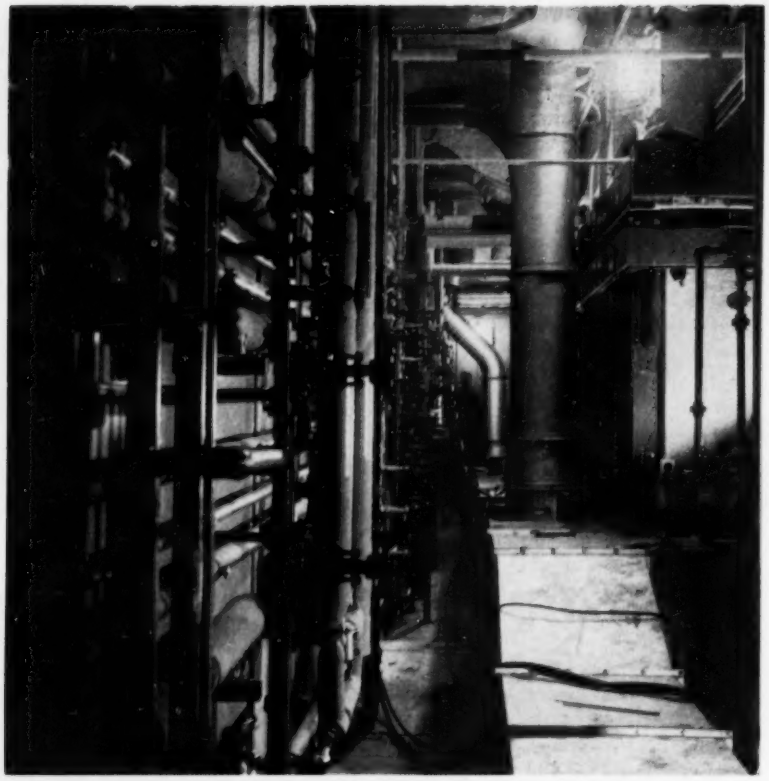
To provide flexibility for installation of additional equipment and for future relocation, it is sometimes considered wise to stub out from each lateral at regular intervals. A similar arrangement may be adopted in service corridors, with stub-outs provided for each module, or basic laboratory unit width. The adoption of this arrangement, which obviously involves considerable additional expense, should be based on a realistic appraisal of the probability of future changes occurring with sufficient frequency to pay off the additional cost.

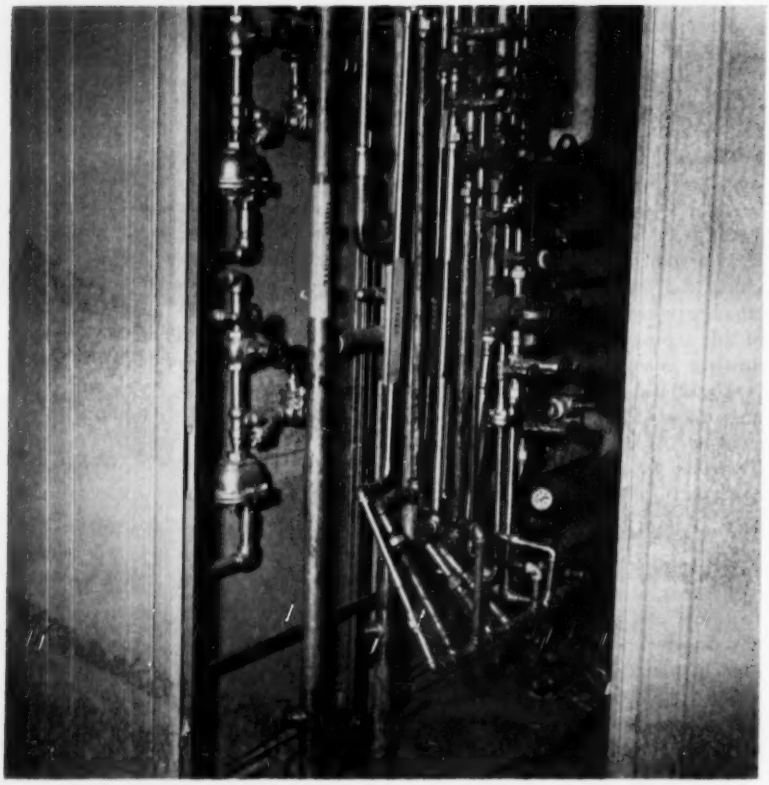
Sizing Lines, Choosing Materials

Sizing piping for laboratory services poses a considerable problem. Reagents and distilled and demineralized water may be distributed from gravity tanks located on the floors above; and since the demand for these services is limited, sizing of these systems may normally be conservative, with due consideration given to the available head and the length of line. Gases and hot and cold water are likely to be subject to considerably greater demand; furthermore, it is often required that set-ups be made using these services on a continuing basis for considerable lengths of time. Fluctuations in pressure of gas to a burner or cooling water to a condenser for instance, might be quite undesirable; consequently, more generous sizing may be justified for these services. The approach to service pipe sizing as used in national codes and other references may be valuable in sizing laboratory piping, supplemented by observations of actual demands developed in other similar laboratories.

The materials of construction for various piping systems are chosen for strength, for fire and other damage resistance, for durability in the particular service, and with due regard to cost of installation. The following paragraphs cover briefly some of the types of construction which have been adopted for a number of installations and which have proved satisfactory in use.

Inert gases such as argon, nitrogen, carbon dioxide and helium may be





6 Laboratory service piping in service corridor adjoining laboratory rooms. Note branch cut-out valves and ventilation ducts and electrical conduits and busses in same space

distributed in ordinary piping materials. Copper tubing offers advantages in the small sizes, screwed piping in the intermediate (½ in. through 1½ in.) sizes, and welded construction in sizes 2 in. and over. Where pressures are about 100 psi and for gases which are difficult to contain — such as helium — it is sometimes advisable to use socket welded rather than screwed construction in the intermediate sizes to hold leakage to a minimum.

Inflammable gases such as methane, propane, hydrogen and acetylene are often distributed through similarly constructed systems. Special care should be taken in designing systems for inflammable or explosive gases to conform with the requirements of all regulative bodies. Acetylene is especially dangerous, and restrictions on distribution pressure and sizes of lines and headers must be strictly observed. All-welded construction for these services offers the advantage of mechanical strength and permanence of tightness of joints, but at greater cost. Pipeways and spaces containing piping for these materials must be ventilated to prevent the build-up of an explosive mixture from possible small leaks. Terrific explosions with loss of life and property have been the result of neglect in this regard. Protection of these piping systems from possible mechanical damage in operation is another important consideration in layout and installation.

Reactive gases represent individual problems. In designing piping for these materials, regulations and recommendations as set forth in the Compressed Gas Association Pamphlet P-1, Safe Handling of Compressed Gases; National Safety Council Safe Practices Pamphlet Nos. 60 and 95, National Fire Code, Vol. I and other references should be consulted. Oxygen is one gas of this type which is commonly piped in laboratories. Sulphur dioxide and other reactive and dangerous gases may also be furnished, depending on the type of work which is planned.

Steam offers no unusual problems at the low (15 to 40 psi) pressures usually furnished to laboratories but the requirements of proper pitch, dripping and the resulting need for condensate returns are present. Steel pipe with cast iron screwed fittings

is often used for sizes up to 1½ in., with welded construction preferred for the larger sizes.

Variety of Water Services

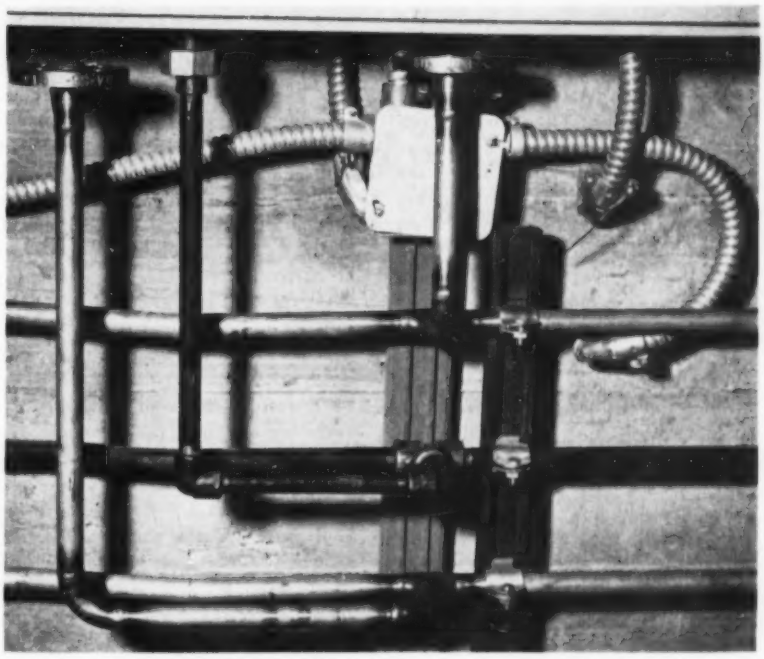
A variety of water services are often specified for laboratories — fire protection system, sanitary or potable system, hot and cold water to laboratories, distilled water, demineralized water and the safety shower system. Local codes and judgment in individual cases will govern regarding the segregation of fire, potable, safety shower and laboratory use water. Many codes require a completely separate fire system, and local safety requirements may be similar with regard to the safety shower system. Further segregation of potable water from the laboratory water may be justified if the possibility exists of contaminating the potable system from laboratory fixtures with toxic or radioactive materials.

The ordinary water systems (fire, safety shower, potable and laboratory use) are often conventional screwed galvanized piping with galvanized malleable iron fittings, although in the larger sizes welded steel construction or cast iron pipe and fittings are frequently specified, the latter usually being limited to buried pipe. Distilled and demineralized water are normally conducted in aluminum lines, although in some instances stainless steel may be preferred. Technical requirements for the water will govern, but aluminum lines offer a cost advantage over stainless. Difficulty may be experienced in attempting to obtain tight joints with aluminum piping made up with threaded fittings. Fig. 5 shows some aluminum screwed piping in which it was necessary to back weld to obtain the required joint tightness under test. The use of aluminum tubing in sizes up to ¾ in. and welded pipe for larger sizes has proved to be more economical and satisfactory in some cases. The aluminum tubing fittings are furnished with anodized threads, to overcome the tendency of this material to seize on tightening.

Many Reagents

Reagents which are often piped in laboratories range from acids — such as nitric, phosphoric and sulphuric — to caustics. The choice of construction materials for these services is dependent on the concentration of the solution, its temperature and the desired service life of the piping, along with economic considerations. Guidance in this choice may be obtained from a number of sources, such as chemistry handbooks, piping manufacturers and material suppliers, and plant experience. Stainless steel is perhaps the most versatile of the more common of such materials, but is unsatisfactory for some services.

Reagents are often corrosive and physical contact with these materials may result in severe burning of the skin and flesh. Distribution from head tanks does not entail the risk of high system pressures which might accompany a system where such solutions are pressure pumped; nevertheless, a leak in a valve packing gland or at a flange can (and has) caused injury. Good practice calls for splash shields at all such points for personnel protection.



7 Close-up of piping showing welded joints in small stainless steel lines

New Valve Types Useful

All-metal valves have been used for practically all types of services with success, but the recent development of highly corrosion resistant plastic materials and the introduction of valve designs to take full advantage of their unique properties gives the piping designer a wider choice of valves than hitherto available.

Diaphragm type valves are available in a wide selection of body, body lining and diaphragm materials. They offer the advantages of elimination of stuffing box leakage, elimination of need for seat and disc maintenance, excellent throttling characteristics and tight closure. Diaphragm replacement may be required as a maintenance item, however, and a ruptured diaphragm may be a more serious problem than a leaky stuffing box in corrosive service or in the case of dangerous materials such as toxic or explosive gases. There is little doubt, however, that this type of valve will find a wide application in laboratory piping.

Vacuum Systems

Two types of vacuum systems are often installed in radiological laboratories. The air sampling system is used in the majority of radiological laboratories. This is an extensive system which takes air samples from all exhaust ducts which may carry air which has been exposed to radioactivity, from all rooms in which radioactive materials may be present, and from locations adjacent to operating areas for all hoods and equipment in which radioactive materials are handled. Air

is drawn through individual sampling filters at each terminal point at a predetermined rate. This rate is set by adjusting valves in the piping at each sampling filter for a given pressure drop. Quick disconnect fittings extending down from the ceiling to which room air sampling filters may be attached may be seen in Fig. 3.

Piping in the air sampling system is usually of decontaminable material from the point at which the sample of air is withdrawn to the filter. Downstream of the filter, conventional material is used. An exception to this rule is the use of diaphragm valves of conventional material upstream of the filter instead of decontaminable stainless steel valves. The need for decontamination of this piping is not normally frequent; consequently, it is less expensive to replace an occasional conventional valve which may be contaminated than to install stainless valves in all of this potentially contaminated piping.

The regular laboratory vacuum system is of lower volumetric capacity, but is carried at a higher vacuum than the air sampling system. This system — which is used for laboratory purposes such as evacuating flasks in which radioactive material might be present — is constructed entirely of stainless steel to provide resistance to the corrosive vapor or liquids which may be carried over into the piping and to provide resistance against the decontaminating solutions which may be employed for removing radioactivity after use. In Figs. 1 and 4 may be seen condensate pots in individual branches of these systems. The pots are provided with drain valves for removing potentially contaminated liquid.

Waste a Major Problem

Waste disposal is a major problem in radiological laboratories. The difficulties involved have led to the necessity for segregating wastes so that appropriate treatment and disposal may be provided for each type at minimum cost. This requires the installation of a number of separate waste disposal piping systems. A typical laboratory may have a sanitary sewer, non-radioactive chemical waste sewer, mildly contaminated sewer, and hot (more highly contaminated) sewer. Conventional galvanized iron screwed pipe with sanitary type galvanized fittings and cast iron pipe and fittings are suitable for sanitary sewers. The chemical waste sewer may be constructed with acid resisting vitrified tile, high silicon iron acid resisting pipe or welded stainless steel. The tile and the iron construction offer good overall corrosion resistance in most cases. However, tile is fragile and may be difficult to keep tight at the joints. The corrosion resistant iron is also quite brittle, but is considerably more rugged than the acid resistant tile. Both tile and iron present some disadvantages as compared to stainless in regard to physically supporting the pipe within a building due to the short pipe lengths and the bell-and-spigot joints. The ultimate choice of material for this system must be made after appraising all the variables involved in the installation.

Tile chemical drain lines must be made up with acid resistant materials. The yarning should be for acid resistant service, followed by hot-poured acid resistant caulking compound. High silicon iron bell and spigot piping may be lead caulked with satisfactory results.

Radioactive sewer systems are usually constructed of stainless steel within buildings for two reasons — they can be made absolutely leak tight, which is a *must* with radioactive solutions, and they can be constructed with relatively smooth interiors at the welded joints which lend themselves to cleaning by flushing. Thus, there is less probability of excessive radioactivity being built up at a retention pocket in the first place, and there is a much better chance of removing it without dismantling the pipe if such an accumulation should occur.

Welding Stainless, Aluminum

Aluminum and stainless steel piping, excepting the thin walled tubing used only in small sizes, is usually fabricated by welding. Both of these materials present difficulties in obtaining satisfactory tightness in screwed joints due to the tendency of the material to seize. In addition, the screwed joint is prone to become a focal point of corrosive attack, thus unduly limiting the life of the piping.

The inert gas shielded tungsten arc process has proved to be highly satisfactory in the fabrication of aluminum and stainless steel piping. Figs. 2 and 7 show typical examples of this type of welding on stainless steel. During the welding process, it is necessary to protect the interior of the pipe and the root of the weld with inert gas. This is often accomplished by introducing stoppers or baffles on both sides of the weld and supplying the volume between the stoppers with a flow of inert purging gas. Recent experiments have shown that it is not necessary to use a monatomic gas such as argon or helium in the purge. A considerable saving with no loss of quality is realized by the use of nitrogen for this service. The inert gas used at the torch must, however, be a monatomic gas.

Testing and Cleaning

Testing of most of the piping systems in radiological laboratories can be accomplished in the usual manner. A good general rule for test pressures is 50 psi or 1½ times the working pressure, whichever is greater. Since the nature of laboratory work is such that cleanliness of the systems is at a premium, care should be exercised in choosing testing media so that a problem is not created later in its removal. Piping for gases and air, which may be required to be moisture-free, should be tested with dry air or gas, using soap solution at the joints to detect leaks. Hydrostatic testing would present the difficult problem of completely removing the moisture during the subsequent cleaning operation.

Cleaning and preparing laboratory piping systems for use requires considerable care in planning and execution. After testing, each system should be flushed or blown out, be thoroughly cleaned by circulating appropriate cleaning solutions, if required, and then be flushed again with a solution or gas which is completely compatible with the material which will be handled in the system.

Oxygen piping requires special treatment from the safety standpoint as well. The slightest amount of grease or oil remaining in oxygen piping constitutes a first-class explosion hazard. Included in the cleaning procedure for this system may be a circulating flush of 5 percent solution of trisodium phosphate in hot water followed by a blowdown with oil-free air or gas.

The use of steam in cleaning laboratory piping is effective but should be used with caution because of the danger of damage to the piping or its supports which can be caused by the expansion of the piping under elevated temperatures.

Locating Sources of Services

The source of laboratory services deserves some comment. Water is normally obtained from a general city or plant distribution system which may be subject to considerable fluctuation in pressure. As previously noted, constant pressure is highly desirable for this service in a laboratory. This may be obtained, provided the minimum pressure available is sufficiently high, by installing a pressure reducing valve in the building service supply. Steam pressure, if obtained from an external source, is also conveniently regulated with pressure reducing valves.

Gases may be obtained from compressed gas cylinder banks which are manifolded together. It is usually most convenient from the standpoint of handling, and also more likely to conform to fire and safety requirements, to locate these installations outside the building under appropriate shelters or in enclosures when protection from low temperatures is required. Care must be taken to segregate the inflammable gases from oxygen with fireproof partitions or by a distance of at least 20 ft or more as required to satisfy local safety requirements.

For convenience in replacing spent cylinders and to prevent interruption of service, the cylinder banks may be divided into equal numbers of bottles and the manifolds sectionalized in such a way that when one-half of the bank is exhausted a simple valve manipulation will isolate the spent half and place the fresh half in operation. The used bottles can be replaced, connected to the manifold and be ready to be put in instant service at the next switch.

Stills and demineralizers and their storage tanks, and the storage tanks for reagents, may conveniently be located on an upper floor. This equipment does not usually create a problem with regard to transmittal of vibration to the building structure, and the gravity feed which is possible with this arrangement is usually adequate for the rate of flow.

Air compressors and vacuum pumps, if located on upper floors, often create very undesirable vibration and noise conditions. The vibration problem is especially serious in buildings in which microbalances, electron microscopes and other precision equipment is used. A basement location or a separate building for mechanical equipment may be justified.

Air Pollution Control Aids Air Conditioning

THE SUCCESSFUL "WAR on air pollution" is resulting in easier air conditioning. Cleaner air, due to improved methods of purification, means that only enough outdoor air is now needed to avoid objectionable carbon dioxide concentration. The result will be reduced sizes of boilers, refrigerating equipment and ductwork.

So said Norman Sharpe, head of the air conditioning and refrigeration department, California State Polytechnic College, at the semi-annual meeting of the American Society of Mechanical Engineers, in Los Angeles.

Suitable ways have been devised for removing nearly all objectionable pollens, smoke and atmospheric dusts with accompanying bacteria and odors. Improved dry filters, electronic precipitators, and activated carbon adsorbers play important parts in complete air purification, he said.

Using purified recirculated air rather than outdoor air for ventilation not only eliminates the non-recoverable loss of cooling the outdoor air to the room condition, but also enables the engineer to design the system for maintaining lower relative humidity in the rooms, with consequently smaller quantities of air and smaller ducts to bring it in.

Studies of ventilation for inhabited rooms have disclosed that in the ordinary quiet respiration of human beings no volatile poisonous matter is in the expired air, other than carbon dioxide. The air expired from the lungs has no odor. Bad breath is caused by unclean mouth and teeth conditions. Odor, mainly body odor, has considerable effect on comfort of people in the room.

The air in an occupied room is contaminated by many sources besides the expired air of occupants. These contaminants are in the form of minute particles of dust. Tests in a hospital room showed that in this dust (which could be removed by a filter) there were micro-organisms, including some of the bacteria which produce inflammation.

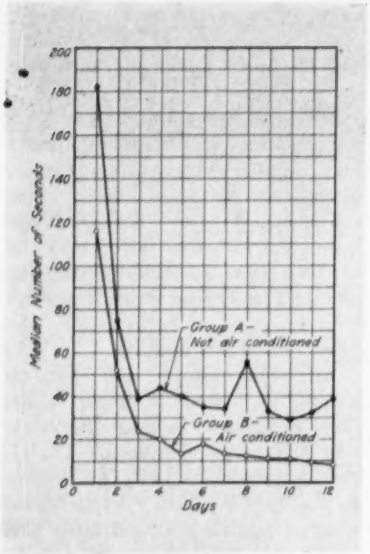
The concentration of carbon di oxide and diminution of oxygen, found in crowded, poorly ventilated churches, schools, theaters and barracks, is not great enough to account for the discomfort produced in many persons. Neither is such discomfort caused by bacteria nor, usually, dusts of any kind. The main causes are excessive temperature, humidity and unpleasant odors.

In most buildings the normal infiltration leakage of air will provide enough oxygen and will keep the carbon dioxide concentration at a sufficiently low level. In tightly insulated buildings, 1 or 2 cfm of outside air per person, depending on their activity, is sufficient.

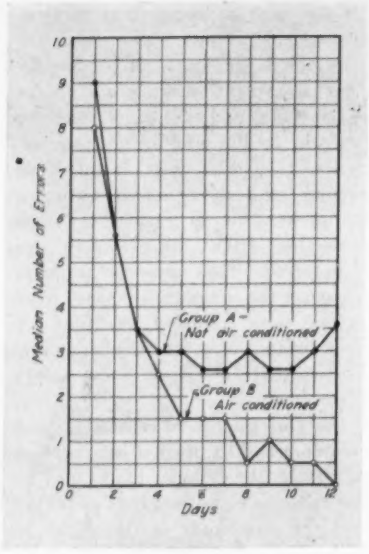
Tobacco smoke presents a greater problem than body odor. About 25 cfm of outdoor air per person is required where smoking is allowed, while 12 may be enough to control body odor by ventilation.

The effect of air pollution on the general health of the people in industrial districts is largely a matter of speculation. Pollutants vary from time to time in a given community. Normally the atmosphere does not become sufficiently polluted to cause distress, but in foggy weather, during periods of low air velocity, or during periods of temperature inversion in the atmosphere, the accumulation may become so great as to cause irritation of the eyes or respiratory passages and even death to those with respiratory or heart ailments.

Purity of indoor air is maintained by removing the pollutant at its source and by diluting the indoor air with cleaned outdoor or recirculated air. Usually a combination of devices such as filters, electronic precipitators, adsorbers and air washers are needed for good air purification, he said.



1 THE COMPLETELY AIR CONDITIONED GROUP took less time to run the maze. The "home" and "work" environments for Group *A* were not air conditioned; for Group *B*, they were air conditioned



2 FEWER ERRORS were made by the completely air conditioned group *(B)*. Results seem to indicate that temperature has its greatest effect on the performance of a task *after* it has been learned fairly well

How Temperature Affects Efficiency

Studies of maze performance of rats indicate less time, fewer errors for group with air conditioned "work" and "home" environments

By Cliff W. Wing, Jr.

Urban Life Research Institute and Department of Psychology Tulane University

MOST OF US HAVE experienced the comfort of air conditioning and have wondered just how much air conditioned comfort helps us in our work. Research bears out the view that air conditioning is helpful to working efficiency. Studies have shown, in general, that the performance of humans and sub-human animal forms is superior under conditions where the temperatures range from 70 F to 79 F to that under conditions where the temperatures are above 90 F.

The results of these studies are interesting, but they give rise to many more questions about the effects of temperature — questions as yet unanswered. In what sense is performance affected by temperature? Is the speed of performance affected? Is the quality of work affected? Is variability in performance affected? How long must a person be exposed to air conditioning in order for the effect to be measurable? Is the effect of air conditioning equally important at all stages of learning a task and carrying it out, or is the effect different at different stages? And what of air conditioning at home, as compared with air conditioning at the office, in its effects upon performance at work?

Why Study Rats?

In order to shed light upon some of these questions, a series of experiments was designed, using albino rats as subjects. In view of the number of times a psychologist is called upon to explain why he often uses rats as the subjects of his studies, perhaps a brief discussion of this point is in order.

It is of course possible to control the lives of rats to a degree human lives cannot be controlled. Many of the factors which might affect the performance of human beings, and thereby obscure the very differences in performance being sought, can be controlled on lower animal forms. As an example, comparisons between two groups of people, one of which works in an air conditioned office, the other in a non-air conditioned office, might have little validity if some of the people in either group lived in air conditioned homes. The effects of air conditioning at home might carry over to performance at work; this is, in any event, a possibility which merits investigation.

As to the applicability at the human level of findings based upon studies of lower animal forms, one need but refer to the biological sciences, where new chemicals almost always are tried out on sub-human species before they are given to human beings. The dosage, or the proportion of one chemical to another, may not always be the same, but the general effects frequently are consistent for lower animals and humans. Similarly, many of the factors psychologists have found to influence rat performance have been significant also in predicting human performance.

"Home" Life, "Work" Life

The complexity of the situations called for by the studies reported here required that rats be used as

subjects. Each group of rats had temperature conditions controlled for "home" life and for "work" life. The conditions for "home" life began, for each rat, at birth. The rats lived constantly under the experimental condition assigned to them except when they were at "work," where the same or different temperatures might prevail, depending upon the experimental condition desired.

On "work" days, each rat was deprived of food for 22 hr, in order to increase the probability of the rat's responding to a stimulating condition followed by the presentation of food. At "work," the rats were placed one by one in a maze with 14 choice points, at each of which the subject could make either a right or a wrong turn. At the end of the maze was a box containing food. Measures of the amount of time taken and the number of errors committed while running the maze were recorded for each rat for 12 successive days of performance in the maze.

The equipment used to control temperatures in these experiments provided both for cooling and for heating a well-insulated room with a floor space of approximately 148 sq ft. The minimum coil temperature of the cooling units was about 40 F. Heat was provided by use of steam coils placed in the duct work leading from the cooling units to the top of the experimental room. The fans of the cooling units provided a constant rate of air flow under conditions of heating or cooling. The possible range of temperature in the room was from 55 to 100 F. Recording instruments were used to make a continuous record of the temperatures in the room.

For the first four experiments in the series, two different temperature conditions were used. One condition was provided by Nature's summer heat in New Orleans, and for this condition the mean daily temperature was approximately 85 F in the "home" room and 87 F in the "work" room. The other was provided by the air conditioning equipment, and the mean daily temperature for "home" and "work" situations was approximately 75 F. Table 1 shows the experimental conditions for the first four groups of rats, *A* through *D*.

What These Tests Showed

IN THE FOLLOWING statements of general conclusions drawn from the comparisons reported, the reader is asked to consider that humidity factors were not well controlled and some of the effects noted may have been caused by both temperature and humidity. It is believed, however, that the consistency of the results supports the following general statements.

1 Subjects living and working under cooler temperatures take less time and make fewer errors than subjects living and working under warmer temperatures.

2 Under conditions where exposure to the air conditioned temperatures is short — during the work period only — measures of running speed are affected more than measures of errors committed.

3 Under conditions where exposure to the air conditioned temperatures is for a longer period of time, during the living or at "home" period, measures of both time and errors are affected.

4 Another general result was that rats exposed to temperatures of 75 F were much more consistent in their performance than rats exposed to 87 F temperatures. That is, the performance of rats exposed to air conditioning, either at "work" or at "home," was less variable for both time and error measures than the performance of rats exposed to the warmer temperatures.

5 Finally, the results from a study of Groups *E* and *F*, in comparison with Group *B*, lend support to the conclusion that temperature affects a task more after it has been learned, or nearly learned, than during the "beginner's" stage.

Insofar as the results of these studies can be applied at the human level — and certainly they should be repeated on the human level before application can be made with complete confidence — they indicate a strong argument for air conditioning in both living ("home") and working conditions. The results suggest also that air conditioning may not have as great an effect upon the initial learning of a task as it has upon the performance of a task once it has been fairly well learned. Lower temperatures at home or at work ought to increase significantly the efficiency of performing tasks already learned.

Effect of Air Conditioning

The first comparison made was between Groups *A* and *B*, the completely non-air conditioned group and the completely air conditioned group. This basic comparison was made principally to substantiate earlier work by other researchers and to determine the extent of differences in performance when two groups operate under consistent wide temperature differences. As was expected, Group *B's* performance was superior to that of Group *A* for both time and error measures. [All differences reported between groups are statistically significant. That is, there are fewer than five chances in 100 that such a difference could have occurred by chance. No group is reported as superior to another unless the difference between the two groups meets the 5 percent level of confidence.] On the average, Group *A* took 63 percent more time to run the maze and committed 45 percent more errors. The time scores for these two groups are presented in Fig. 1; the error scores, in Fig. 2.

The comparison between Groups *A* and *C* is similar to comparing a man whose home and office are not air conditioned to a man whose office — but not his home — is air conditioned. Group *C* took significantly less time to run the maze than Group *A* (41 percent less time), but the 6 percent drop in the number of errors committed by Group *C* was not sta-

TABLE 1—EXPERIMENTAL CONDITIONS for the four groups, *A, B, C, D*

Group	"Home" environment	"Work" environment
A	Not air conditioned	Not air conditioned
B	Air conditioned	Air conditioned
C	Not air conditioned	Air conditioned
D	Air conditioned	Not air conditioned

tistically significant and could have occurred by chance. These results imply that during working hours, temperature has a greater effect upon performance associated with physical activity (running) than upon the quality of performance (errors).

The same implication may be drawn from comparing the results of Groups *B* and *D*. Group *D* — with the air conditioned "home" and the non-air conditioned "work" situation — took significantly more time to run the maze than the totally air conditioned Group *B*, but error differences were not significant. Again, the change in temperature of approximately 12 F during the "work" period caused a significant change in time taken to run the maze, but not in the number of errors committed.

Value of "Home" Comfort

The conditions for the next two comparisons were the reverse of those for the last two comparisons. In each case, the groups compared worked under the same conditions, but the "home" environments were different. Groups *A* and *D* worked in non-air conditioned temperatures, but Group *D's* "home" was air conditioned, in contrast to the "home" environment of Group *A*. Groups *B* and *C* worked in air conditioned surroundings, but Group *C's* "home" was not air conditioned, in contrast to the "home" environment of Group *B*.

Where both groups worked in the non-air conditioned situation, the group living in an air conditioned "home" performed significantly better in terms of both time (43 percent difference) and errors (32 percent difference). Similarly, where both groups ran the maze under cooler temperatures, the group which lived in the air conditioned "home" took significantly less time (38 percent difference) and made significantly fewer errors (42 percent difference).

"Experts" Affected More

For all of the groups in the study, graphs or curves like Figs. 1 and 2 were plotted showing the rate of learning — the rate at which time-to-run-the-maze and number-of-errors-made decreased over the 12 day series of runs. One of the most interesting results of the studies was that curves appeared to be similar for all groups during the first runs on the maze. Differences in the curves began to show up only after the rats had had considerable experience (see Fig. 1 and 2 for two examples). This result seemed to indicate that temperature has its greatest effect on the performance of a task *after* it has been learned fairly well, rather than during the earlier stages of actual learning.

In order to check this apparent result, two more groups were set up. Group *E* ran the maze under conditions where the temperature *averaged* 75 F for the 12 "work" days, but the temperature for the first three running days was 90 F; for the second three days, 80 F; for the seventh, eighth and ninth days, 70 F; and for the last three days, 60 F. Group *F* ran the maze with the temperature steps in reverse order, performing the last three days under conditions of 90 F.

A comparison between Group *E* and Group *B* (the totally air conditioned 75 F group) revealed no differences in either time or errors. Group *F*, however, experiencing higher temperatures in the *latter* stages of performance, took significantly more time (89 percent) and made significantly more errors (89 percent) than did Group *B*.

[The author wishes to express his appreciation to New Orleans Public Service, Inc., and to the Minneapolis-Honeywell Regulator Co. for their assistance in designing and furnishing the equipment for this study.]

Clay Flues Vent Acid Fumes

CLAY FLUE LINERS were erected a story at a time before any reinforcements were placed. Forms for pouring concrete were prefabricated, speedily put into place. Boxes visible at top of form are for flue inlet ducts

A UNIQUE clay flue lined venting system to carry away acid fumes has been installed in the $2.5 million addition to the Allen-Bradley Co. factory in Milwaukee.

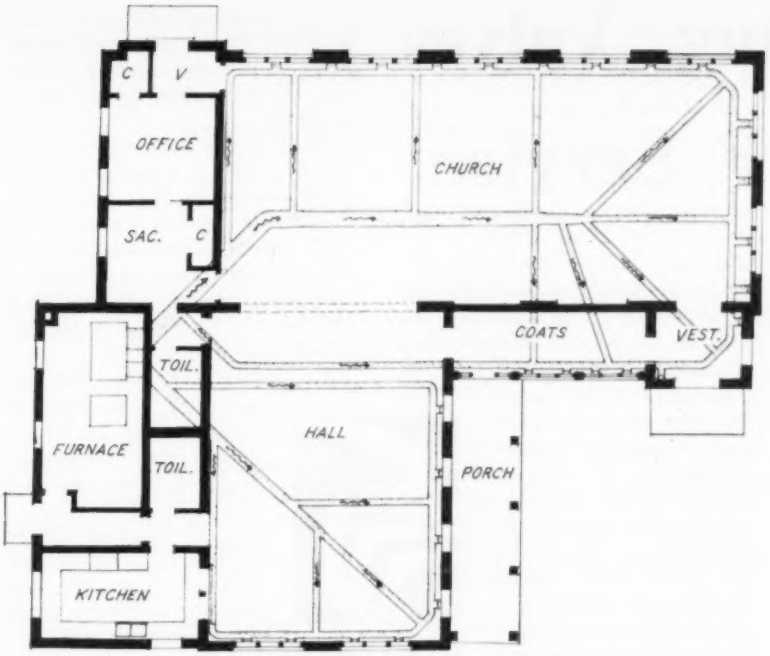
The venting system is an integral part of the construction, being contained in the hollow concrete columns that comprise the supporting framework of the building. Each support column in the outside walls of the new addition contains three of these flues. The columns were built of reinforced concrete with the central core of clay flue liners.

The flue liners were erected a story at a time, before any reinforcements were placed and concrete poured. This method was made practical by a unique device. Small metal channels were spotwelded base to base, to form H-shaped aligning tabs. These tabs, when installed, merely kept the sections of flue liners from slipping sidewise.

Mortar was used at the joints and was troweled smooth over the area surrounding the joint. Steel rod reinforcements were then placed, and wooden forms erected around the work. Concrete was finally poured to complete the support column.

Five thousand feet of 18 in. square clay flue liners were used in erecting 25 ventilating columns, each from the second story to the roof of the seventh story. Since each bay of the building contains three support columns, an ample spacing of flues is available for future use.

Clay flue lining was selected because it is resistant to the action of hot and cold fumes with moisture or acid content. It protects the containing columns from attack, and vents the fumes for harmless dispersal into the upper atmosphere. Some of the fumes carried arise from quenching oils used in heat treating, exhaust gases from the furnaces, silver brazing flux vapors, volatile metallic oxides, dust and fumes from molding operations, and degreaser fluid fumes.



TWO FURNACES are used for zoning purposes. The small one is controlled from the pastor's office, supplies some heat to the church and hall areas. Ducts from small furnace are not shown

COOLING CAN BE ADDED to the heating installation serving the church for complete year 'round comfort in the future

Warm Air Perimeter System Heats Basementless Church

THE RECENTLY COMPLETED St. Peter's Episcopal church, West Allis, Wisc., is one of the few churches in the country to use a perimeter warm air heating system. The building is a basementless structure — in a climate where temperatures of 25 deg below are not too uncommon.

According to the Rev. Gordon R. Olston, the parish is highly pleased with the heating system. The building has an area of 4695 sq ft, and is heated by two oil fired furnaces. The smaller unit heats the kitchen, offices, toilets and sacristy (an area of 1180 sq ft).

The total building cost was $53,760. The heating installation amounted to $4757 — about $1 per sq ft of floor area.

All underfloor ducts are galvanized iron, encased in concrete, the tops being set at 2½ in. below the floor. The perimeter duct at the outside wall is 9 in. in diameter. One inch of glass foam insulation was used at outside walls below grade, extending down 2 ft. The main supply duct, with feeder arms extending to the perimeter at several spots, diminishes in size as its length increases.

Zoning the Heating

Two furnaces were used for zoning purposes. The large furnace is used for heating the church proper and for partially heating the fellowship hall. The fellowship hall is made a part of the church during services, but during the week it is frequently divided by a folding partition and used independently. The fellowship hall is supplied from both furnaces. The thermostat for the large furnace is in the parish hall, and the one for the small furnace is in the pastor's office. When the fellowship hall is open to the church and a low unoccupied temperature is desirable, the small furnace, which is controlled from the pastor's office, will supply some heat to the area. This, however, is compensated for by the fact that the large furnace will operate less frequently and control will still be maintained. When the fellowship hall is operated independently, enough heat will be supplied from the small furnace to keep the room warm at the same time that the church is kept at a relatively low temperature.

Cooling Allowed For

The system is installed so that eventually it can be converted to three zones. The outside air intakes are large enough for 100 percent outside air. Cooling can be provided in mild weather by the addition of automatic dampers and controls. Space has been provided for the addition of cooling coils and a compressor.

Air is distributed through slotted perimeter diffusers, which lend themselves to good distribution for cooling when installed.

The church was designed by Lindl-Schutte & Associates, architects-engineers. The heating contractor was the Advance Sheet Metal & Heating Co.

Steam Piping, Valves for 1100 F Service

IN THEIR PAPER on steam piping and valves for 1100 F, Frank A. Ritchings and Sabin Crocker* pointed out that results are available from extended research on the behavior of austenitic and ferritic steels in a steam atmosphere at 1100 F. They pointed out that allowable stresses at temperatures up to 1100 F and higher have been assigned by code committees with respect to long-time strength as determined from creep and stress-to-rupture tests. Two large boiler-turbine units employing austenitic piping for 1100 F throttle steam temperature are being installed this year. Austenitic steels are definitely expensive, however, and alloying elements, particularly nickel and columbium, are in short supply, they stated.

Their paper reviewed existing data and speculated on whether low-alloy-content ferritic steels could be made to serve the purpose. Spot comparisons were made of the relative cost of austenitic and ferritic steel pipe of equivalent carrying capacity.

Their paper was prepared for and presented at the 1953 semi-annual meeting of the American Society of Mechanical Engineers, held in Los Angeles, and was also published (by special permission) in two parts in the August and September issues of HPAC. To complete the presentation of the subject, the discussion on this valuable paper is published this month.

E. G. Boissier:

Design Temperature

Reference is made in the paper to the differential temperature obtaining between the inside of a pipe and the outer wall, particularly at the position of flange joints, valves, etc.

We have been faced with a similar problem in England, and it is one of the factors which, unfortunately, has to be accepted. In one particular case we are joining chrome-molybdenum-vanadium steel pipes with mild steel weld metal (mainly because the alloy weld metals at present available give us creep resisting properties considerably less than those of the parent metal.) Because of this, it has been decided that the joint shall be supported by flanges and suitable bolting arrangements. It so happens that we were instructed as to the type of steel to be used for the pipe work of this particular installation but, had it been left to us, I am certain that we should have employed 18/11/1 stainless steel so that the tubes could have been joined by plain butt welding, and so the differential temperature problems created by the use of flanges could have been avoided.

Selection of Materials

We consider that for pipes which are to operate at 1050 to 1100 F, the limits for the chrome and nickel contents of type 347 steel are too wide, and we should prefer to keep these within the ranges of chrome, 17 to 18.5 percent, and nickel, 11 to 13 percent.

Chrome-Molybdenum-Vanadium-Steel

Reference is made in the paper to the importance of correct heat treatment of the above type of steel, in order to obtain the optimum creep resisting properties, and also to the fact that after such heat treatment the steel may have a low ductility and possibly be liable to brittle failure.

The opinion is held, in England, that after heat treatment as suggested by the authors, the steel would be expected to have a low ductility, particularly in view of the coarsening effect of the 1875 F /1975 F treatment. We also consider that there is no advantage to be gained with molybdenum contents in excess of about 0.5 percent and chrome additions in excess of about 0.5 percent will reduce the creep resisting properties.

At the present time we are installing, in England, piping for 1050 F conditions, made from 0.5 percent chrome/0.5 percent molybdenum /0.25 percent vanadium type steel, and our heat treatment consists of normalizing from 1740 F/1790 F, followed by tempering at approximately 1275 F for 3 hr minimum.

After the foregoing treatment, specimens have shown an elongation of at least 8 percent after varying periods of time, up to 10 years, at 1020 F.

In the paper, doubts are expressed regarding the permanence of the creep resisting properties of the chrome-molybdenum-vanadium steels, but specimens tested in England with a load of 6 tons psi at 1020 F are unbroken at 120,000 hr.

Austenitic vs. Ferritic Steel

It must, of course be agreed that the cost of stainless steel tubing is higher than that made from chrome-molybdenum-vanadium steels; but this may not necessarily imply that there will be a corresponding difference between the cost of the finished piping installations. Additional cost may be incurred where chrome-molybdenum-vanadium tube is used, due to the following:

a) The thickness of tube to be employed may entail the use of a greater length of pipe in order to obtain the necessary flexibility.

b) Flanges and bolts will, at present, be employed to support the mild steel weld metal used for butt joints.

c) The necessity to temper finished pipes for a comparatively long time.

We feel, in England, that we can make satisfactory butt welds between stainless steel pipes, when using a controlled "ferrite" electrode, and numerous tests have shown that crack-free welds can be produced.

It has been argued that the amount of delta ferrite present in the weld metal (usually between 3 and 6 percent) will result in embrittlement during the expected service life of the joint; but short time tests indicate — fairly conclusively — that the amount of "sigma phase" produced will not be significant.

In the paper, reference is made to

*Mr. Ritchings is Chief Mechanical Engineer, and Mr. Crocker is Mechanical Engineer, Ebasco Services Inc. Mr. Crocker is a member of HPAC's board of consulting and contributing editors.

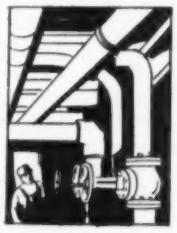
floating type superheater headers, but it has been our experience that these do not always move as intended. As pipework fabricators, we prefer the superheater header to be anchored, as calculated stresses in the pipework can be accepted with confidence.—E. G. BOISSIER, Aiton & Co., England.

A. W. Rankin:

With the continuous advances in average throttle conditions which are occurring in the power generation industry, it is necessary for both manufacturer and the purchaser alike to give continued careful consideration to the steels which are available for long-time high temperature service. On both economic and strategic grounds it is necessary to minimize the employment of strategic alloys, particularly when their use does not necessarily ensure more reliable performance. The paper raises many pertinent questions concerning piping and valve steels for the higher temperature levels, and the writer is pleased to make available to the industry his company's experiences which bear upon those questions.

Use of Vanadium

Considering first the chrome-moly-vanadium steels, it is somewhat surprising to find the statement that "vanadium may be a rather tricky addition" since vanadium has been used in bolting alloys for close to 15 years and is now in rather widespread use for steam turbine shells, valves and rotors, both in the U. S. and abroad. In addition, there has been much recent development work in alloys containing up to 1 percent vanadium, and alloys with 0.8 percent vanadium are now commercially available. The writer does not wish to imply that vanadium is an element which can be carelessly employed, but in constructing steam stations for higher temperature levels, the purchaser can rightfully demand that only competent vendors, manufacturers and engineering organizations be used, and that all processes be adequately controlled. In particular, however, it appears that only by introducing vanadium or some equivalent precipitation-hardening element is there any possibility of employing the ferritic steels at the higher operating temperatures, and experience already available within the organizations of the major steel producers shows that vanadium additions can be adequately controlled. As a further illustration of the growing recognition of the vanadium-bearing steels, a recent ASTM specification, A356-52T, has been issued which contains several different turbine casting alloys which utilize vanadium at about the ¼ percent level.



It is useless, however, to add a precipitation-hardening element without introducing a heat treatment to make such additions effective. In the case of the vanadium-containing steels, this means a normalizing and tempering treatment, and if only an annealing treatment is used the vanadium addition has no advantage. In answer to the question of the permanence of the superior properties obtained by the normalizing and tempering treatment, it should be noted that it is general practice in large steam turbine rotors and shells to utilize normalized and tempered steels, and to a considerable extent this practice is also followed on major valve castings throughout industry; in addition, of course, a normalizing and tempering treatment has been used for many years for high temperature bolting as is outlined in ASTM A193. The degree of permanence of the resulting structure is indicated by the tempering response curves of which several examples for chrome-moly-vanadium piping steel are shown in the authors' reference No. 9. Starting with a value of 210 Brinell, 100,000 hr at 1050 F would drop this to only 175, while 100,000 hr at 1100 F would drop it to 160. This decrease in hardness proceeds more slowly as time increases, and subsequent softening beyond the 100,000 hr point would be relatively insignificant. Specifically, the writer's company has run rupture tests on this steel out to 16,000 hr, and creep tests to 30,000 hr, and, accordingly, the high temperature physical properties reported for this steel already contain the major effects of prolonged exposure to high temperature.

Further test data are available on the rupture strength of the chrome-moly-vanadium alloy, and the writer is taking the liberty of summarizing these as follows:

100,000 hr rupture strength; 1 percent chromium, 1 percent molybdenum, ¼ percent vanadium
(air cooled from 1050 C, tempered 12 hr at 1300 F)
(numbers in parenthesis are laboratory item numbers)

900 F	1000 F	1100 F
73000 (2395)	34000 (2395)	
50000 (2394)	28000 (2394)	
38000 (2645)	27000 (2645)	18000 (2645)
31000 (2688)	21000 (2688)	12500 (2688)

Item 2395 was a 115 lb induction-melt ingot which was given only a short temper, and this accounts for the relatively high rupture strength at 900 F. Although some of the values reported in the foregoing table are lower than the corresponding values presented in reference No. 9, the average values substantiate the average rupture-strength curve given in the writer's previous publication on this alloy. (Authors' Reference No. 9) In particular, the rupture strength is clearly superior to the rupture strength of the more common ferritic alloys.

Equivalent Pipe Sizes

The equivalent pipe sizes presented in the authors' Table 5 are valuable in expressing the additional costs entailed in using the austenitic stainless steels. This table does not present, however, any evaluation of the additional welding costs which arise with the austenitic steels because of the growing demand for the elimination of the backing rings, or because of the special electrodes and high post-weld temperatures needed to assure minimizing the possibilities of sigma formation. Furthermore, the strategic alloys needed for the stainless steel may become difficult to obtain if defense requirements should unexpectedly increase. With respect to the evaluation of the chrome-moly-vanadium steel, further emphasis should be given to the conservative *S* value suggested for this alloy by the authors. In particular, it will be noted from the creep and rupture strength curves that this alloy is comparable in strength at 1100 F to the type 347 steels, whereas the authors suggest for it an *S* value considerably below that of the type 347 steel. The writer's company is not yet utilizing in piping the full potentialities of this chrome-moly-vanadium alloy, but this is simply a conservative approach taken while getting rather prolonged field experience with a new alloy. The writer suggests that

a more complete picture of the steels available for 1100 F service would be obtained if the authors would furnish, in addition to the evaluations based on their suggested conservative S value, an evaluation of the possible cost savings if the chrome-moly-vanadium steel is utilized on the same bases as the other alloys.

Welding Piping

With respect to welding of steam piping, the concept of using an electrode that deposits weld metal with the same composition as the base metal is a generalization from which frequent departures are made. The most obvious of these is the welding of carbon steels in which the carbon content of the weld deposit is appreciably lower than that of the base material. Another obvious example is in the welding of the titanium-stabilized type 321 austenitic stainless steels on which a columbium-stabilized type 347 rod is used whenever it is necessary to obtain adequate resistance to intergranular corrosion. In particular, however, one can refer to the very frequent use of austenitic electrodes for making restrained welds in ferritic steel to indicate that the basic concept in selecting the electrode alloy is simply to obtain a reliable weld of the required physical characteristics. With the chrome-moly-vanadium alloy, we are using a vanadium-free electrode because prolonged high temperature tests have indicated that the vanadium in the form as currently deposited in the weld metal does not contribute to high temperature strength. We recognize that the resultant weld deposit is lower in strength than the base metal, and we compensate for this, as the authors point out, by building up the pipe ends with weld deposits, which ends are subsequently fully heat treated. This is basically no different than the practice of utilizing upset ends at the weld joints as shown, for instance, in the ASA B31 Code for Pressure Piping. We have been working quite actively for several years to develop a weld deposit whose high temperature strength is comparable to the base material, and believe that we now have a particular composition in which the desired results will be achieved.

With respect to the graphitization resistance, we have not been aware of any significant graphitization even in chromium-free weld deposits proper, either in the field or laboratory tests. The serious graphitization which has plagued the power generation industry has been of the chain form at the heat affected zone, which is well outside the zone of dilution between the weld deposit and the base material. Although we have not encountered any graphitization in weld deposits proper in laboratory tests of over 40,000 hr duration at 1100 F, we are currently developing an electrode with 1 percent of chromium because of the several questions that have arisen on this point.

Austenitic Steels

Turning now to the austenitic steels, the degree to which such a steel is fully austenitic depends more on the chemical composition than the heat treatment, as suggested by the authors. For instance, an austenitic weld deposit is cooled very rapidly from the completely molten condition, and yet it is not necessarily fully austenitic unless the electrode composition has been carefully balanced. It is the practice of the writer's company to specify the composition of our steam turbine austenitic steels so that they are fully austenitic even without a rapid quench; in the austenitic electrodes, however, the composition is balanced so that the weld deposit does contain a small amount of ferrite.

In the welding of the austenitic steels, we have also encountered the problems of root cracking and sigma formation. In the two 1100 F units which we have constructed for the Kearny station of the Public Service Electric and Gas Co. of New Jersey, of which one is already in operation, the welding was done without backing rings by several different methods, the electrode deposited a composition containing between 1 percent and 4 percent ferrite, while a post-weld treatment of 1925 F was employed. By these three innovations, we believe we have eliminated the root bead cracks, and at least minimized considerably the formation of sigma at the operating temperature. As a matter of interest, a paper is now being prepared to present to the industry the contributions by the writer's company in the development of this electrode and post-weld treatment.

Welding Dissimilar Metals

In conclusion, the writer would like to discuss the welding of dissimilar metals, specifically the welding together of austenitic and ferritic steels. This is a type of welding which is usually avoided where possible, but experience indicates that it can be accepted when the economic results justify it. In particular, it should be noted that literally thousands of jet engine wheels were made using an austenitic-to-ferritic weld during the last war, and this process is still being used for gas turbines by the writer's company. In addition, about 12 austenitic-to-ferritic welds have been made in 1050 F turbine main steam piping, and it is the writer's understanding that such joints are also made frequently in steam boiler construction. In addition to the austenitic-to-ferritic welds made with a type 347 electrode now in service in 1050 F steam stations, we also have a weld between type 347 austenitic stainless steel and 2¼ percent chrome—1 percent moly ferritic steel pipe sections, of 14 in. OD with a 3 in. wall, made with a 78 percent nickel, 15 percent chrome electrode which has been in laboratory test for almost two years. This weld has been cycled between 300 F and 1100 F more than 250 times with no defects whatsoever being found at any part of the joint. The particular feature of the weld deposit is that it has an expansion coefficient equal to that of the ferritic steel, and accordingly puts the differential expansion stresses on the austenitic rather than the ferritic side of the weld. The deposit is quite ductile and has high temperature properties at least equal to those of the chrome-moly-vanadium alloy. A test vessel containing such a weld is now being prepared for installation in a steam station utilizing 1050 F steam, and at this location it will be subjected to full throttle pressure and temperature, and will be thermally cycled as frequently as conditions will permit. Based upon the current laboratory tests, however, this weld deposit holds considerable promise in the design of piping for high throttle pressures and temperatures.

Inspection of Pipe

The writer is in complete agreement with the authors' statements that a thorough inspection be made

of each individual pipe length. It is the practice of the writer's company to require from the pipe manufacturer a certificate detailing the chemical composition and the physical properties, and stating that etch and flattening tests have been made in accordance with our specification on each end of each pipe length. In addition, the pipe manufacturer conducts the usual hydrostatic tests on each pipe length. All the foregoing data are reviewed by both the fabricator and our own laboratory. Further micrographs are obtained from the fabricator following the final normalizing and tempering treatment together with a certificate that the specification heat treatment has been followed. The writer wishes to stress particularly the use of the ultrasonic inspection methods detailed in the authors' reference No. 29. All of our main steam piping is given a complete ultrasonic inspection before fabrication, and, in addition, we subject the bent portions of the chrome-moly-vanadium alloy to a second ultrasonic inspection after bending. In our judgment, all main steam piping should be subjected to an ultrasonic inspection in order to ensure that the quality of the piping is adequate for the intended service.

Close Control Needed

In the authors' conclusions, they state that it should be feasible to extend the ferritic steels to 1100 F throttle conditions, but without specifically recommending any particular ferritic alloy. The chrome-moly-vanadium steel, even when so conservatively evaluated as in this paper, offers significant economic gains, but its use demands careful control on all the design, manufacturing, fabricating and installation operations. At the same time, it is proper for the purchaser of such high temperature equipment to demand careful control over all the equipment intended for such advanced throttle conditions, and the manufacturers must be prepared to furnish such close control. — A. W. RANKIN, General Electric Co.

D. B. Rossheim, E. F. Sheaffer:

The authors have prepared a thought-provoking and helpful paper which is of timely interest to all high temperature, high pressure piping engineers. The following comments are intended to supplement the authors' treatment of certain aspects of the subject.

Code Bases for "S" Values

The subject matter treated under this heading might more properly be given a broader title, such as "Design Stresses and Other Criteria." At the present time, as pointed out by the authors, the ASME boiler and pressure vessel code governs the suitability of a material for a given service by establishing allowable stresses and by approval of material specifications. In addition, the transition temperature for materials in low temperature service is regulated by minimum impact values. Shock resistance is not controlled above minus 20 F, there are no requirements on fatigue strength, nor are elevated temperature tests required to assess ductility either on a short time basis or under prolonged exposure to temperature. Also, as implied in the paper, the data which are used for creep rate and time to fracture are usually extrapolated from values obtained in 500 to 1000 hr tests and hence do not include the effects of structural changes in the metal which may possibly occur over longer intervals of time.

There is considerable difference of opinion as to the influence of ductility on safe performance; however, in services where plastic deformation may occur, we believe there is general agreement that retention of ductility is significant and may be particularly important for the heat affected zones of welds. In general, it is our feeling that more attention should be paid to high temperature fatigue and impact properties with greater effort toward assessing the properties of materials which have been subjected to stress at elevated temperature for a considerable length of time. The research physicists and metallurgists can perform a valuable service for the piping engineers in the direction of establishing or clarifying relations between fracture under creep conditions (so-called stress rupture) usually having an appearance of low ductility, and the high ductility exhibited in short time tests on remaining pieces of the same material.

It would have been appropriate for the authors to have mentioned, in this section, the "stress range" to which the thermal expansion stresses are related. Essentially, this is a concept which follows from the observation that relaxation or stress relief takes place during operation, which results in all or the greater part of the expansion effects eventually vanishing only to reappear as a shutdown or cold stress. As a result, piping systems are subjected to a cycle of stress of an amplitude or range which remains relatively constant for initial or subsequent cycles. In accordance with Piping Code rules, this stress range is kept within a value derived from the ambient and service temperature allowable stresses. This approach assumes that failure due to thermal expansion effects will be essentially of a fatigue nature and related to the number of cycles of temperature change involved.

Cold Spring

The authors' brief remarks on the subject of cold spring appear in need of clarification. They correctly point out that a high temperature line will eventually acquire about the same amount of cold spring regardless of whether this condition is obtained by prespringing during erection or by self springing during service. This fact, however, refutes rather than supports the subsequent conclusion that prespring of from 2/3 to the full computed expansion is advisable. The missing point is that prespring serves two purposes:

1) It reduces or eliminates the amount of plastic strain occurring in the pipe due to relaxation.

2) It reduces or eliminates initial high order hot reactions on connected equipment.

The first of these is of doubtful benefit since the amount of strain is necessarily small and, as it only occurs once, it is not significant from fatigue considerations. The second is of great importance where sensitive equipment such as turbines are involved, which may be thrown out of alignment or otherwise damaged by hot piping reactions which may reflect the full yield strength of the material before relaxation with time. This philosophy has been accepted in the proposed revisions to the Code for Pressure Piping ASA B31.1. [see "Report of Task Force on Flexibility" May 4, 1953.] In these rules

the same allowable stress range is permitted whether or not the system is presprung. The effect of prespring in lowering initial reactions is recognized to the extent of allowing the hot reactions to be reduced by 2/3 of the prespring.

Attention is also directed to the fact that these new proposed rules of the Piping Code provide a relation between the anticipated cycles of service and the allowable stress range which may be used, and also for an increase in the basic stress range. In making these rules available for comment and criticism, the Piping Code committee has also presented certain alternate provisions advanced by H. V. Wallstrom in representing the writers' company as a member of the Task Force on Expansion and Flexibility. These include rules to define the piping for which stress analysis would be mandatory and represent an effort to recognize the transition of the Piping Code from a designer's code of good practice to a safety code, suitable for adoption by states and municipalities for enforcement of rules for pipe construction. Interest on the part of enforcement authorities is already in evidence in connection with the new Section VIII of the Piping Code on transmission lines, which has been adopted or is in the process of adoption by several states, and further by the organization of a conference committee composed of the chief inspectors of each state and the provinces of Canada.

Welded Joints

In the section on selection of materials for 1100 F service, austenitic steels are stated to be difficult to weld without producing cracks. In the section under welding austenitic steels, further emphasis is placed on the difficulties of making satisfactory austenitic weldments and undesirability of quenching from above a so-called critical range. It would take considerable space to adequately refute the authors' above contentions; however, a paper entitled "Fabrication of Austenitic Stainless Steel Steam Piping for Operation at 1100 F," by W. G. Benz and R. H. Caughey of the writers' company, presents information to show that satisfactory austenitic welds in heavy wall pipe can be achieved without undue difficulty. Connecting an initial anneal and carbide solution treatment with preheating and stress relieving, is not valid in the writers' opinions. A lack of observed benefit in preheating austenitic steel is in no way connected with the initial treatment of the material. As to postheating, it is true that such treatment or service temperatures above approximately 900 F tend to precipitate carbides with reduced ductility and impact strength. However, the values obtained for both of these properties are quite adequate, and usually superior to those obtained for ferritic steels.

In connection with welded joints between dissimilar metals, it is recommended that such a weld between a valve and a stub end be made in the shop, so that field welds will be between similar materials. It would be desirable to extend these precautions to further favor the dissimilar weld joint by choosing a location so that stress intensifications, including bending stress or other local effects, are avoided. In the case of a valve, the welding end is of such limited length that discontinuity stresses may be anticipated; accordingly, it would be preferable to first shop weld a stub end of the same composition to the valve so that the dissimilar weld is located between two short sections of pipe which are, however, of sufficient length so that extraneous stresses will not be imposed upon the weld. It is, of course, always desirable to perform the attachment of welding end valves to piping in a well equipped shop rather than in the field, even at the expense of additional welding.—D. B. ROSSHEIM, Chief Mechanical Engineer, The M. W. Kellogg Co. and E. F. SHEAFFER, Mechanical Engineer.

Herman Weisberg:

The authors have done a thorough job outlining the factors involved in the design of a piping system for 1100 F operation. The principal question raised is the possibility of utilizing ferritic steel in place of the austenitic steel now in use for this service; and a case is made for a chromium-molybdenum-vanadium composition which in the laboratory shows promise of high strength at this temperature.

Sound Field Welds

The suitability of a steel for high temperature, high pressure service, in the last analysis, depends to a large extent on the ability to produce sound field welds in heavy wall piping. The particular ferritic steel under discussion owes its high temperature strength to a special heat treatment. Aside from the fact that the code writing bodies have been reluctant — and, in fact, up to this time have entirely avoided crediting a material for extra strength at high

COST COMPARISON for main steam piping
(2-¼ Cr-1 Mo A335, P22 VS 18/8 Cb A312, TP347)
for 1050 and 1100 F normal operation
1,350,000 lb per hr at 2350 psi
Velocity = 15,000 fpm maximum
Length = 375 ft total for two lines per boiler

Item	T = 1050 F Normal		T = 1100 F Normal	
	P22 Forged and Bored	TP347 Seamless	P22 Forged and Bored	TP347 Seamless
Internal diameter	7¼"	7¼"	7¼"	7¼"
Wall thickness, calculated, minimum including C allowance for corrosion, based on 1% operation at T + 50 F + 12½% for seamless	2.19"	1.01"	3.25"	1.32"
Wall thickness, used	2¼"	1⅛"	3⅛"	1⅜"
Outside diameter	11¾"	9⅝"	13⅞"	10"
S for continuous operation, psi	5,800	13,100	4,200	10,300
S × 1.20 (1% operation at T + 50 F), psi	5,040	12,360	5,600	9,120
Total cost: fabricated piping	$102,000	$76,500	$136,000	$107,000
Unit cost per ft, fabricated piping	$270	$203	$368	$285
Total cost erected with insulation	$168,400	$145,100	$245,200	$180,600
Total unit cost per ft	$448	$388	$653	$482
Cost comparison	100%	86%	145%	107%

temperatures resulting from heat treatment — there is considerable question whether this steel can be welded in the field without destroying its high temperature properties at some point in the weld heat-affected zone of the base material. This is a most dangerous type of impairment of strength because it occurs in a plane directly across the pipe. One pictures the type of failure which occurred due to graphitization at Springdale. We have had in service at Essex Station (1000 F) a similar material, without the chromium addition, for almost six years. The design stress, however, is no higher than in the 2¼ chrome 1 moly pipe in the same piping system. Prior to utilizing this type of steel at stress levels which take into account the improvement in high temperature strength due to heat treatment, there should be considerably more test data developed on the long-time high temperature properties determined from across-the-weld specimens.

Welds in austenitic piping also present a problem, as pointed out by the authors. Considerable progress, however, is being made in developing welding techniques, which result in sound and stable austenitic welds, as has been related in a paper by Caughey and Benz. Furthermore, keeping in mind future requirements for still higher temperatures, we prefer to stay with this higher alloy material, which from corrosion and strength considerations is good for considerably more temperature than 1100 F; and we have therefore tended to use more of it rather than revert to the lower alloys, which must be extended to their maximum capability in order to meet the requirements of operation even at 1050 F.

Seamless Stainless Tubing

Within the last year we have procured a heat of pierced and rolled seamless stainless tubing for the main steam piping of a 185,000 kw unit being installed at Burlington. This is 10½ OD x 1½ in. wall, type 347 steel tubing and is possible in the austenitic material only because of the considerably reduced wall thickness. In order to utilize piping this small in diameter on so large a unit, the steam flow is divided between two leads originating at the quarter points of the outlet superheated steam header. The inlet tubing to this header is cross-connected, so that equal steam temperatures result in each of the outlet steam leads. Steam velocity is 15,000 fpm. Piping designed for this velocity arranged as described is now in service at Kearny, and is operating satisfactorily from the standpoint of noise and vibration as well as equalization of temperature between the two leads. In testing the emergency stop valves, one lead has been shut off completely at full load, forcing most of the steam through the other lead, without appreciable increase in noise or vibration levels. Inasmuch as the emergency stop valves may be tested during offpeak periods, when if necessary the turbine load can be reduced, even higher design velocities are practicable if found economical.

It appears, therefore, that this arrangement, utilizing seamless tubing rather than the much more expensive forged and bored pipe, can be extended to any size unit now under consideration. As a result we find that it is possible to install an 1100 F austenitic main steam piping system for only slightly greater total cost (see table on p. 88) than a 1050 F ferritic piping system, which because of the lower allowable working stress must of necessity be forged and bored.—H. WEISBERG, Mechanical Engineer, Electric Engineering Dept., Public Service Electric and Gas Co. of New Jersey.

A. E. White:

The paper is an excellent example of the service which our specification and code making bodies have rendered in the selection of proper materials for high temperature service.

Welding Dissimilar Metals

The statements with regard to welded joints, as they relate to both the ferritic and the austenitic types of welds, are most constructive. The reference to "welded joints between dissimilar metals" could possibly be expanded somewhat to point out that the difficulty in welding dissimilar metals increases as the diameter of the metals increases. That is, there would be no difficulty in welding 2 in. superheater tubes, even though the welds connected dissimilar metals, but it would be quite a different problem if the diameter of the tubing or piping were of the order of 10 or 12 in.

The writer quite agrees with the statements made by the authors that "it is good practice to weld stub ends of pipe material to the valve ends in the shop." Also, the writer is in complete agreement with the statement that special care should be taken in the examination of welded joints, such as the use of x-rays, gamma rays, a supersonic reflectoscope examination, and other methods which will throw light on the quality of the weld.

The writer wishes to compliment the authors of this paper on their valuable contribution to matters relating to design of steam piping and valves for high temperature service. —A. E. WHITE, Director, Engineering Research Institute, University of Michigan.

A. B. Wilder:

Messrs. Ritchings and Crocker have presented very helpful information regarding steam piping for 1100 F steam. Reference is made to the heat treatment of ferritic materials for high temperature service. Some of the results we have obtained with Cr-Mo-V steel may be of interest and

TABLE 1—CHEMICAL ANALYSIS

Steel	C	Mn	P	S	Si	Cr	Mo	V
A	0.12	0.52	0.014	0.016	0.18	0.96	0.86	0.20
B	0.17	0.43	0.011	0.019	0.25	0.96	0.98	0.21

TABLE 2—HEAT TREATMENT and tensile properties

Steel	Heat Treat Air Cooled	Yield Strength, psi-0.2% Offset	Tensile Strength, psi	Elong., %-1"	Red. Area %
A	1650F-1 hr	37,000	77,000	35	77
B	1925F-2 hr 1300F-12 hr	106,000	120,000	21	66

TABLE 3—STRESS (psi) for rupture

Temp., F	Steel:	1000 Hr A	1000 Hr B	10,000 Hr (Extrapolated) A	10,000 Hr (Extrapolated) B
900		80,000	86,000	76,000	83,000
1050		33,500	51,000	21,500	47,000
1200		9,500	20,000	5,500	13,500

are shown in the accompanying tables.

Importance of Heat Treatment

The importance of heat treatment is illustrated by Steel B. This material, after exposure at the temperature indicated for periods of 10,000 and 100,000 hr, will be creep rupture tested. Alloys of the Cr-Mo-V type require high solution temperatures for the vanadium carbides, and the mechanical properties are increased by aging at temperatures below the thermal critical range. The evaluation of the stability of the creep rupture properties is, therefore, important.

We do not see why a suitable welding rod containing vanadium with molybdenum and chromium cannot be developed to produce sound welds. It would be desirable to use a rod which will possess strength properties similar to the Cr-Mo-V pipe material.

Examination of Pipe

Reference is made to the usefulness of photomicrographs of each end of each length of pipe. We do not believe this practice is necessary, but we do appreciate the value of representative photomicrographs of the product. These would be useful for future reference.

With reference to the ultrasonic examination of piping material for flaws, it should be pointed out that this type of testing is not adaptable at the present time to the production of pipe in the pipe mills. The method is very slow and expensive. The most practical way to inspect pipe by this method is in the pipe fabricating plant. When the ultrasonic method for inspection has been improved to the extent that the interpretations are more certain, and the time required for inspection is reduced, the method should receive more favorable consideration throughout the industry. The user, at his own convenience and with his own facilities, may inspect pipe by the ultrasonic method. However, rejections which may be the responsibility of the producer can only be based upon defects which are beyond the standard ASTM specifications to which the pipe was produced.—A. B. Wilder, Chief Metallurgist, National Tube Div., U. S. Steel Corp.

H. W. Wyatt:

The authors are to be congratulated for their objective and clearcut presentation of the problem of "austenitic versus ferritic" steel for 1100 F steam service.

Comments by the writer are from the viewpoint of manufacture of ferritic castings, and their applications in high pressure, high temperature steam valves.

When steam temperatures went well beyond 750 F, and somewhat above 900 F, two casting materials came into the codes and specifications. Carbon moly (ASTM A217 — grade WC1) was the more widely used. Investigations since the 1943 graphitization occurrence in piping have shown that the less widely applied grade, the nickel-chromium-molybdenum casting composition, grade WC4 of A217, is completely free from graphitization. No evidence of structural, corrosive or mechanical deterioration has been noted in the nearly 20 years since it was brought out. As a result of investigation and study, the metallurgists with whom the discussor is associated and the discussor believed that the load carrying capacities of the ½ percent molybdenum types of steels, such as grades WC4 and WC6 of A217, are not as high as might be desirable for services — say to 1050 F. Therefore, a modification of WC4, with 1 percent molybdenum (grade WC5 of A217) was developed and used in main stop and other valves in the first large U.S. central station operating at 1000 F, in 1946. Since that time, valves of WC5 material have been installed in main steam lines of a number of stations operating from 960 F to 1050 F, at pressures to 2150 psi at 1050 F. Fabricators have met all procedures and operator qualifications in joining them to the following and other wrought piping materials.

A213-T12 (1 percent Cr, ½ percent Mo)
A213-T21 (3 percent Cr, 1 percent Mo)
A213-T22 (2-¼ percent, Cr 1 percent Mo)

No joint troubles have been reported in service of these weldments to piping.

Grade WC9 of A217, as mentioned by the authors, also has had consideration and use. As shown by the authors, in cast materials (reference No. 13) and by others for wrought materials (reference No. 11) WC9 leaves something to be desired in its stress-rupture characteristics at 1050 F.

The authors suggest that it is desirable that the nominal "chemistry" of piping and casting be similar. It is agreed that it is desirable that the mechanical and structural characteristics of the casting and pipe each be suitable for the contemplated service, and be suitable for joining by the same electrode, i.e. the weld deposit be compatible to casting and pipe. The authors point out clearly the problems inherent in suitable joining of austenitic and ferritic materials, also with the vanadium bearing ferritic steels. Adequate references are given to the inadequacies and/or marked differences in mechanical, structural, expansion and other characteristics. However, such differences in behavior are not found in joining the compositions WC5 or WC9 with T22 piping. The casting process is quite different in several respects from wrought processes. In comparing cast and wrought steels of similar alloy content, the casting process tends to give greater hardenability, both due to the process itself and to the usual higher manganese and silicon which are used to promote casting soundness. The silicon and manganese are alloying elements and in any comparison should be considered as well as the chromium, molybdenum, vanadium and nickel. The relative hardenability of T22 piping is 10.3, WC9 is 14.5 and WC5 is 10.4. WC5 matches T22 quite closely in hardenability. It also possesses a multiple bead hardness before stress relief, much lower than WC9 (carbons the same). WC5 in these respects actually behaves structurally and mechanically closer to T22 than does WC9. The expansion, contraction and dilatometric characteristics of all three materials are closely alike. WC9 and WC5 are similar in creep (1100 F) but WC5 has considerable advantage in stress-rupture. Creep and stress-rupture tests of WC5 at 1150 F show much less drop in strength for an increase of temperature from 1100 to 1150 F than for a 50 deg temperature increase from 1050 to 1100 F. Final results will be presented later.

The authors present data on one cast chrome-moly-vanadium steel and mention another cast chrome-moly-vanadium steel to be introduced into

[*Concluded on page 95*]

New Control Regulates Air Conditioning

A NEW METHOD for interpreting the outdoor weather conditions directly into the air conditioning load control is being used in the new 16 floor, Y-shaped Los Angeles Statler Center hotel and office building.

Eight solar compensators are located on a 16th-floor penthouse with each one facing a different direction. The orientation of each instrument corresponds to one of the major exposures of the building's five wings. These compensators measure the degree of solar heat which enters the hotel rooms, subtract from it the outside temperature in the shade and then apply the result to the air conditioning system, it is explained by the Minneapolis-Honeywell Regulator Co. The "sun penetration" temperature and the shade temperature are measured by electronic thermometers located inside and outside the compensator, respectively. As the angle and intensity of the sun's rays change throughout the day, the eight compensators automatically vary the cooling capacity required.

In addition to this central control, the 1300 guest rooms and some 150,000 sq ft of commercial offices are equipped with individual controls so that each occupant can "dial his own weather" if he does not wish standard temperatures.

The total cooling capacity supplied by three centrifugal refrigerating machines is 2200 tons, according to Carrier Corp. Approximately 680,000 cfm of conditioned air is delivered through the building by the 60 centrifugal fans used. A small-diameter conduit system is used to convey the air at high velocities to the supply outlets where the air is mixed with room air as it is delivered into the rooms.

Steam Turbine Drive

A substantial part of the cooling for the building is obtained virtually free of operating cost. A steam turbine driving one of the centrifugal cooling machines takes steam from the boiler, acts as a pressure reducing device while turning the centrifugal, and sends the steam on at the proper pressure for use in heating hot water, and in the sterilizers, the steam tables, the dishwashers and in the laundry.

Minimum consumption of water for refrigeration condensing is insured by continuously recirculating all water used through forced draft cooling towers concealed on the roof.

High Velocity Ducts

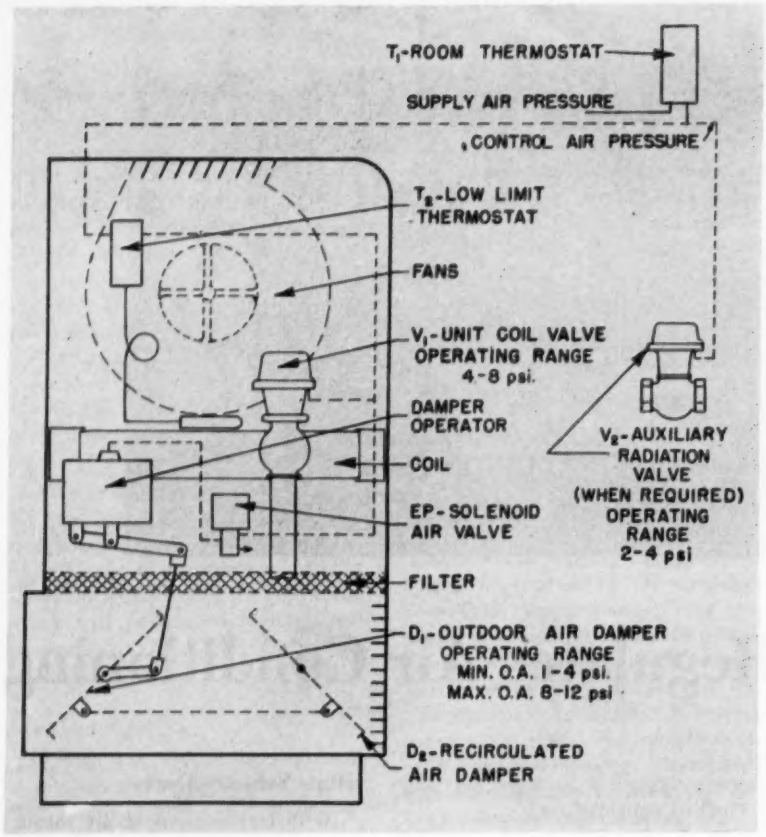
With transmission of air through small high velocity conduits, no sacrifice of ceiling heights or raising of the roof line was necessary. Since there are no moving parts in the supply outlets, noise problems are avoided and no maintenance is required in the individual rooms.

All air supplied to the rooms is outside air which has been filtered, washed, dehumidified and heated or cooled according to season.

Cooling towers and central station air conditioning equipment are housed in specially constructed penthouses with walls which appear to be solid but permit free passage of outside air to the equipment.

Architects and engineers for the $25 million building, said to be the largest hotel project to be constructed in this country in more than 20 years, were Holabird & Root & Burgee of Chicago, and William B. Tabler of Hotels Statler Company, Inc., associate architect.

The general contractor was Robert E. McKee, General Contractor, Inc. of Los Angeles, and the mechanical contractor was Mehring & Hanson of Los Angeles, Chicago and Washington, D. C.



TYPICAL DRAW-THROUGH unit ventilator with control system. Such units are usually installed on the floor below the windows

How To Control Unit Ventilators in School Buildings

By Harold W. Alyea
Chief Field Engineer
Johnson Service Co.

This is the first of a group of articles by Mr. Alyea on the fundamentals of the control of unit ventilators for school rooms. The application of these units and the temperature control cycles are discussed.
Future articles will cover:
Improved methods of control and new developments in unit ventilator construction
Control of unit ventilators when hot water is the medium
Requirements for careful sizing of automatic temperature control valves

A UNIT VENTILATOR is a forced air heating unit equipped with dampers for introducing outdoor and recirculated air in varying quantities with the fans operating continuously during periods of normal occupancy. Either steam or hot water may be used as the heating medium. It is designed primarily for heating and ventilating spaces having a relatively high occupancy load, with its attendant need for positive ventilation, or for applications where large internal heat gains from occupants, sun, etc., make it necessary at times to dissipate excess heat. While any room having these characteristics might of course represent a suitable application for a unit ventilator, this series will be based particularly on their use in school classrooms, the application for which they were originally designed.

All units are equipped with dampers, heating coils, fans and filters. Compartments at each end provide space for piping, automatic valves, damper motors and accessories. Air is discharged from the top of the unit and proper distribution throughout the room is achieved by adjusting the velocity of the discharge air and by using the proper design of the outlet grilles. While floor mounted units are the most common, some units are arranged also for ceiling mounting in a horizontal position where required. Many modern installations have matching storage or utility cabinets, extending from either or both ends of the unit ventilator along the outside wall, to present a unified appearance.

Designed to provide sufficient heating capacity, the unit ventilator should also insure rapid warm-up of the room in the morning, provide the required ventilation and heating during occupancy, and introduce additional outside air when excess uncontrolled heat must be dissipated. All of the air is filtered as it enters the unit, and after being heated by the coil is distributed throughout the room.

In most school buildings, the heat is either shut off during the night and at other unoccupied times, or the building is controlled during

non-occupancy hours at a low "economy" temperature. In the morning, it is desirable to bring the rooms up to occupancy temperature as quickly as possible. The unit ventilator may be sized to accomplish this rapid warm-up; or additional sources of heat, such as radiators, convectors, or wall coils may be installed. During the warm-up period, when the room is unoccupied, the outdoor air damper is closed and the unit operates with full recirculated air. During this period also, the valve on the unit coil, and the valves on other controlled sources of heat, if any, are open.

When the desired room air temperature has been reached, the outdoor air damper must open to a position which will admit the necessary amount of outdoor air for ventilation, and the recirculated air damper must close proportionately. Any auxiliary heat sources usually are shut off automatically at this time.

The unit ventilator then operates to supply sufficient outdoor air for minimum ventilation requirements and to supply sufficient heat to maintain the correct occupancy temperature. Should the space temperature tend to exceed the desired level, the heat output decreases until, when no heat addition is required, the valve at the unit coil will close automatically. Any rise in room air temperature resulting from internal heat gains, sun effect, etc., requires that the outdoor air damper be gradually opened from the minimum to the maximum position, while the recirculated air damper is closed proportionately to admit up to 100 percent outdoor air for lowering the temperature.

The operation of unit ventilators may include any of several variations from the preceding description, but the objective usually is the same — to obtain maximum heat output for quick warm-up, minimum required ventilation and correct space temperature during periods of occupation, and maximum cooling by introducing additional outdoor air when necessary.

Ventilation Requirements

The minimum amount of outdoor air needed for ventilation is adjustable, and usually is referred to in percent of total unit capacity. Many states have laws governing the minimum amount of ventilation which must be provided in public spaces, such as classrooms. This amount is expressed in cfm per person, or as the number of air changes per hour. These minimum requirements can be reduced to percent of unit capacity, once the size of the unit has been determined. In states which have no such laws, this matter is left to the judgment of the engineer or architect who usually follows accepted standard practice in the given locality.

Major Problem Is Cooling

A fact not too often realized is that in the present-day classroom the major problem is not one of heating but rather one of cooling, even during periods of relatively low outdoor temperatures. The internal heat gain from lights and occupants is considerable. To this must be added, on sunny days, the heat gain from solar radiation. This latter factor is particularly important because of the present trend toward larger window areas and because, by nature, it is variable in time and intensity.

After the initial morning warm-up, a room with an east exposure may require no further heat, or may even require some cooling when the students have gathered, the lights have been turned on, and the sun has come up, even when the outdoor temperature is as low as 15 or 20 F. Later in the day, after the sun has moved around to other sides of the building, the east zone may require heat. Similarly, the south zone may require cooling during the latter part of the morning and most of the afternoon, while the west zone will need maximum cooling late in the afternoon.

Variations in solar radiation, wind velocity and direction, lighting, occupancy and outdoor temperature all contribute to the varying demand for heating and cooling which is imposed upon the unit ventilator. To successfully perform its double function of providing the necessary amount of ventilation and maintaining a comfortable thermal environment, the unit must be capable of responding immediately to changes in such demands.

Automatic Control Essential

An understanding of the cycle of operation of a unit ventilator, and the wide variations of conditions under which it must operate, makes it clear that automatic controls are a necessity in obtaining the desired results. These controls must be capable of producing the sequence of operation specified, maintain the desired room temperature conditions, and yet be simple, rugged, and free of complicated, expensive and frequent service requirements. Automatic controls are available for any of the various modifications of the unit ventilator operating cycle.

By far the largest number of unit ventilators employ a cycle of operation which provides the following:

1) 100 percent recirculation and full unit heat output for rapid warm-up when the room is below the desired temperature. Auxiliary radiation (if any) also operates at full capacity.

2) The minimum quantity of outdoor air required for ventilation is introduced as the room air temperature approaches the thermostat setting. The amount of recirculated air is reduced proportionately, and the auxiliary radiation is shut off. The room is then ready for occupancy.

3) The unit ventilator coil valve is modulated to maintain the desired room temperature.

4) If conditions are such that the room temperature continues to rise after the unit coil valve is fully closed, the outdoor air damper modulates from its minimum to its maximum open position while the recirculated air damper closes proportionately. When the outdoor air damper is wide open, the unit operates at full cooling capacity.

5) The unit discharge temperature is controlled at all times by means of a low-limit control to prevent drafts. This low-limit thermostat overrules the room thermostat whenever the discharge temperature drops below a predetermined limit (usually 55 to 60 F).

Control Cycle Described

A typical pneumatic control diagram to produce the cycle of operations described above is shown here. Electric controls may also be used. The pneumatic room thermostat T_1 is supplied with a constant air pressure, usually 15 psi, and varies its control pressure between 0 and 15 psi in proportion to changes in room temperature. This control pressure actuates spring-opposed bellows or diaphragms in the valves and damper operator. The desired sequence of operation is obtained by selection of proper spring ranges in each device.

For example, when the control pressure is 0, the room is below temperature, outdoor air damper D_1 is closed and the unit is on full recirculation. Unit coil valve V_1 and auxiliary radiation valve V_2 (if used) are open. This produces maximum heating for rapid warm-up.

As the room temperature approaches the setting of T_1, the control pressure begins to increase. At 4 psi, outdoor air damper D_1 is opened to its minimum position and auxiliary radiator valve V_2 is closed. Also at 4 psi, unit coil valve V_1 begins to throttle, and, at 8 psi, it is completely closed. The outdoor air damper remains in its minimum position until the coil valve is closed. Then, from 8 to 12 psi, it moves from its minimum position to wide open, while recirculated air damper D_2, being interlinked with D_1, closes proportionately.

Low limit thermostat T_2 is inoperative unless the discharge temperature becomes low enough to cause objectionable drafts. At this point (usually 55 to 60 F), the low limit thermostat overrules the room thermostat to prevent a further decrease in the discharge temperature.

A solenoid air valve, *EP*, usually is included in the control system. It is connected to the fan motor circuit, and its function is to positively close the outdoor damper whenever the unit is stopped.

The damper operating sequence is accomplished with two springs. A light, flexible spring permits the damper to open to its minimum position at a low value of control pressure. The damper operator then engages a heavier spring which delays further movement until the valve is closed. This second spring may be part of the damper operator itself, or may be incorporated in the damper. In either case, adjustment of the minimum outdoor air from zero to at least 50 percent is included.

Other Control Cycles

Another unit ventilator control cycle, sometimes used, provides minimum outdoor air only, with no additional outdoor air beyond this amount. However, the amount of this minimum outdoor air may be set at any value up to 100 percent of the unit capacity. It requires only a single-range damper operator, but otherwise the cycle is similar to the one previously described.

A third cycle provides no fixed minimum quantity of outdoor air, but includes a thermostat in the outdoor air and recirculated air mixture to maintain a fixed mixture temperature by operating the dampers. This mixture temperature usually is 55 or 60 F, and hence the mixture thermostat serves as a low-limit as well as to provide a quantity of outdoor air in proportion to the outdoor temperature. If the mixture thermostat is set at 60 F, and the recirculated air temperature is 75 F, then, at 0 F outdoors, 20 percent outdoor air will be admitted and, at 60 F outdoors, 100 percent outdoor air will be admitted.

How To Control at Night

The unit ventilator fans normally are stopped at night. While individual units are provided with on-off switches for the fan motor, common practice is to provide wiring for the units in such a manner that they can be started and stopped from a central point, usually the boiler room. On the larger installations, electrical panels are often installed in the corridors, each panel serving a group of adjacent units. This provides greater flexibility and additional economy, since, in the larger schools, all of the rooms are not necessarily operated on the same daily schedule.

In mild climates, night control of the space temperature is not necessary. Shutting off the boilers completely will not result in an excessive drop in space temperature, and the building can be brought back to occupancy temperature in a reasonable time and without over-extending the boiler capacity. For more extended off periods such as weekends, it may be necessary to start the boilers occasionally during the coldest part of the season.

Where the climate is colder, the units may not be controlled at night, but the boilers are operated at reduced pressure or at timed intervals, to maintain a reasonable night temperature. Since this temperature will be lower than the setting of the room thermostats, the unit valves will be open and the units will function as convectors.

Why Dual Temperature?

In severe climates, it is common practice to install dual temperature thermostats in the rooms. Such thermostats have a normal day setting and a reduced night setting, the switchover usually being accomplished at a central point. Often, a single switch is arranged to stop the unit fans and to change the thermostats from day to night control. In most installations, the switching is arranged in zones because of difference in occupancy periods. Separate switches also are provided for auditoriums, gymnasiums, etc., so that these rooms can be heated to occupancy temperature only when needed. Electric time clocks may be employed instead of manual day-night switches. Such clocks are available for providing the same schedule of operation each day, with a weekend cutout, or they may be arranged for providing a different schedule each day. In either case, the timing of the switchover operations is adjustable.

When the thermostats are switched to their night setting (usually about 60 F), the unit fans are stopped and the outdoor air damper is closed. Because the room air temperature at this time is above the night thermostat setting, the unit coil valve, and the auxiliary radiator or convector valve, if used, both close. Thus, all of the heat is shut off and remains off until the room temperature drops to the night setting of the thermostat. At this point, the unit coil valve begins to open and the unit functions as a convector. The valve opens just enough to maintain the desired night temperature. If the unit output is not sufficient to maintain this temperature with the unit valve wide open, the auxiliary radiator or convector valve opens.

Night Control

There is a growing tendency to eliminate auxiliary radiation in rooms equipped with unit ventilators. The chief purpose of the auxiliary radiation is to aid in rapid morning warm-up, and in maintaining the night temperature. In the control diagram, the auxiliary radiation valve V_2 is closed after the room air temperature has been increased for occupancy. The morning warm-up can be accomplished by starting the units a little earlier.

The night function of the auxiliary radiation can be eliminated by running the units intermittently when on night control, whenever their convective capacity is insufficient. In a pneumatic control system, this requires the addition of a pneumatic-electric switch connected in the fan motor circuit. During day operation, this switch is closed and the

fans operate continuously. When the units are switched to night operation, the outdoor air dampers are positively closed, and the pressure-electric switch opens to stop the fans. The control then functions exactly the same as described previously except that, after the unit coil valve is wide open and if the convective capacity of the unit is insufficient to maintain the night temperature, the pressure-electric switch closes and starts the fans. The outdoor air damper, of course, remains closed. There are many other arrangements for obtaining intermittent operation at night, but the one described herein is fairly simple.

Multi-Purpose Schools

A growing trend in schoolhouse design in many localities is to make the buildings suitable for multiple purposes. Since a community has a large investment in its school plant, it is only natural to put it to the greatest possible use, and in many cases the school becomes a community center. It may be used for large and small meetings of all kinds, for night classes in adult education, vocational guidance and manual training and for various social functions.

Night activities usually require the use of only a small portion of the building, however, such as the auditorium, one or two of the classrooms, or perhaps the manual training shop. While it is desirable that the unused portion of the building remain on intermittent night operation at the reduced night temperature level for reasons of economy, it is just as important that units in the occupied rooms be capable of being restored to their normal daytime function of continuous fan operation, with thermostat control of the unit valve and dampers to maintain the desired temperature and provide ventilation.

In buildings where intermittent night operation of the units is not employed, the dual thermostats are often furnished with a pushbutton for restoring the day setting while the remainder of the building remains on night setting. Thus, a given room can be maintained at the day temperature if desired, but since the unit fans are shut off from a central electrical panel, positive circulation, and outdoor air for ventilation, will not be obtained.

The use of intermittent night cycles offers a means of obtaining complete daytime operation of any unit at night, including continuous fan operation, proper ventilation and normal daytime temperature, by including a simple manual switch in the thermostat. This switch overrules the central day-night switch for the respective unit and permits switching the unit back to night operation when the occupants leave. A further requirement is that, should the occupants neglect to restore the unit to night operation upon leaving, the unit automatically must fall in step with the other units when the control switch is again operated. Thus, it is not possible to leave any unit on day operation continuously and defeat the purpose of the dual temperature control system.

Steam Piping, Valves for 1100 F

[*Concluded from page* 90]

ASTM specification A217. The two materials should not be confused. The first has a special treatment producing high hardness and high creep strength accompanied with low ductility. (High normalizing temperatures and careful age-hardening are used.) The proposed ASTM chrome-moly-vanadium steel is said to be heat treated to a low hardness and a more modest creep strength accompanied with good ductility. The average of the reported values of creep strength at 1100 F of composition similar to the proposed A217 chrome-moly-vanadium steel approximates the creep strength of WC5 at the same temperature.

The writer agrees with the authors that study and trial may show that through proper selection and application the usage of ferritic steels at 1100 F may be safely feasible, and if so, economical.

Again, may I say that Messrs. Ritchings and Crocker are to be complimented in bringing the problems involved so clearly into focus.—H. W. Wyatt, Metallurgical Research Div., The Lunkenheimer Co.

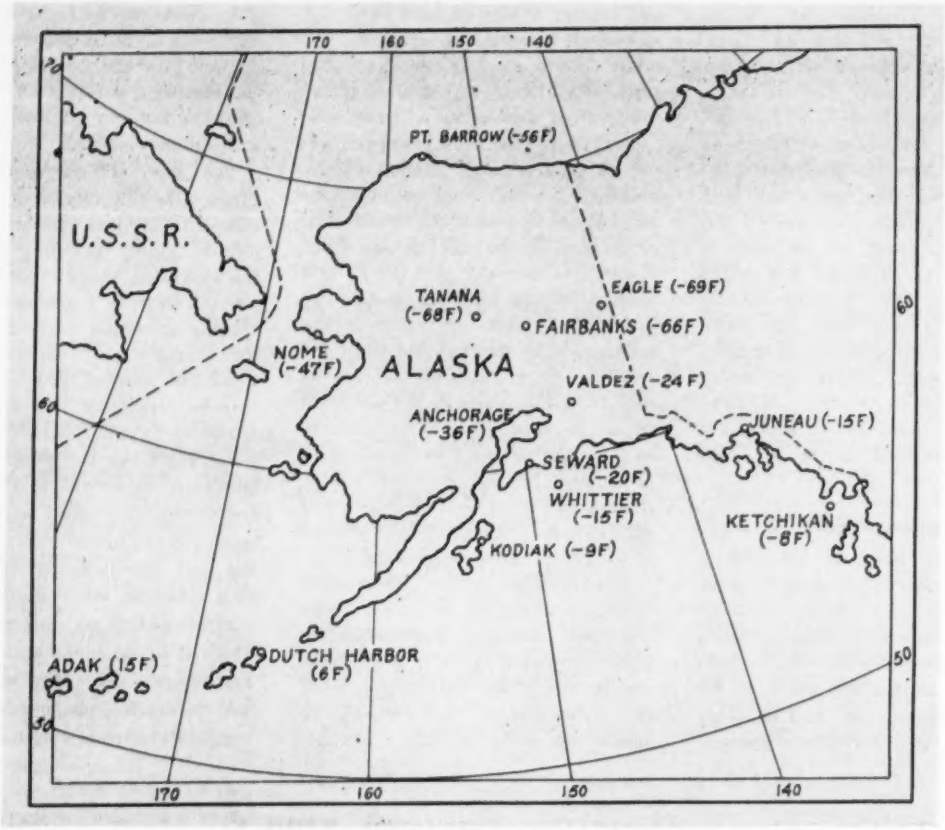
Authors' Closure:

The authors wish to express their feeling that the several discussors of the paper have contributed materially toward fulfilling the objectives of the session at which the paper was presented. The authors were invited to contribute a paper that would survey present knowledge applicable to the design of steam piping and valves for 1100 F, and with a view to stimulating further discussion of the subject. It is indeed gratifying that the discussors have responded so well in bringing different slants on the expected behavior of materials available for 1100 F steam service.

As expressed in the paper, the authors were in hopes that others would comment on various angles of the high temperature problem and bring to bear ideas that will help in obtaining an economic solution. The authors themselves are open-minded on this subject and are chiefly interested in seeing that all avenues of approach are explored so that the possibilities of alternative materials will be better understood.

The relative costs of austenitic and ferritic construction given by Mr. Weisberg are somewhat at variance with the cost data and estimates of the authors. Mr. Weisberg's figures for P-22 forged-turned-and-boredpipe are a step higher than those of the authors for this material, whereas his figures for type 347 seamless pipe are a step lower. Consequently, there is a crossing of base prices which tends to magnify the variance in cost ratios derived therefrom and leads to different conclusions concerning the relative costs of the two kinds of steel. In view of the difficulty in reducing such comparisons to the same absolute bases, it is recommended that those wishing to pursue the matter further estimate their own costs for the specific cases they wish to compare.

Frank A. Ritchings, Chief Mechanical Engineer, and Sabin Crocker, Mechanical Engineer, Ebasco Services, Inc.



LOWEST TEMPERATURES on record for Alaska cities

Heating Arctic Buildings

Unusual weather, different construction methods and clothing insulation require special consideration

By Gordon R. Whitnah and Millard H. LaJoy

A RAPID GROWTH of industry and construction in the Arctic has been witnessed in recent years. For many citizens of the United States, the development of Alaska has opened new fields for business enterprise. The military importance of Alaska and the Aleutian Islands has placed new emphasis upon the need for adequate shelter in these areas of severe winter weather. The purpose of this article is to present design data for heating systems to be installed in the Arctic. The unusual weather conditions, special clothing and different construction methods found in this area make it necessary for the heating engineer to consider these design differences. Specific data are given for Alaska and the Aleutians, although many of the considerations apply to any cold climate.

The authors are, respectively, Instructor and Associate Professor, both of the Department of Mechanical Engineering, University of Minnesota.

Because of the great size of Alaska and the fact that both coastal and interior regions are involved, a simple description of the general climate cannot be made. Some coastal locations, warmed by the Japanese current, are at all times above zero F while the northern and interior regions live up to the popular conception of the Arctic with temperatures as low as −71 F on record. Over most of Alaska the range in tempera-

ture is more than 100 F. The greatest range is at Fort Yukon, where the maximum temperature recorded is 100 F and the lowest temperature, −71 F. The map illustrates the wide variation in climate by showing the lowest recorded temperature at several locations.

Another climatic factor of interest to the heating engineer is that of wind velocity. The extremes for most locations are in the range of 50 to 55 mph although hurricane velocities have been known to occur, and a 100 mph gale is on record at Pt. Barrow. These extreme velocities are of value to the structural designer but cannot be used as a basis for infiltration calculations by the heating engineer. Average winter wind velocities and prevailing directions for several locations are shown in Table 1. It is interesting to note that these average wind velocities do not exceed those of many cities in the United States.

There are many other points of interest which do not enter directly into the calculation of building heat load but are often important factors in the design of heating systems. Information concerning soil types, frost depths, degree day accumulations and other design data are shown in Table 2. The degree day column offers an illustration of the severity of Alaskan winters when compared to values for U. S. cities.

Outdoor design temperatures are not listed in these two tables, since they have not been established on any standardized basis. Conventional practice in cold climates has been to assume an outside design temperature 10 to 15 F higher than the lowest temperature on record.

A review of the weather information presented indicates that some Alaskan buildings, if maintained at 70 F, must be designed for a temperature difference as high as 125 F. This means that the heating system must deliver approximately 40 percent more heat than the same building would require in the northern U. S. Thus, these differences in weather conditions must be considered.

TABLE 1—WIND DATA for Alaska

Location	Average wind velocity, mph (for Dec., Jan., Feb.)	Direction of prevailing wind
Anchorage	4.9	NNE
Barrow	11.8	ENE
Dutch Harbor	7.4	S
Fairbanks	3.1	N
Juneau	8.0	NE
Nome	9.2	ENE

From a Weather Summary for the Alaska area published by the U.S. Navy Department Hydrographic Office, 1944.

Construction Methods Differ

The severe winters of the Arctic cause the earth to be permanently frozen in some locations. This soil type is listed in Table 2 as *permafrost*. The presence of permafrost requires that construction methods be altered from those used in most parts of the United States. The main difference in construction is in the building foundations and floors. The two methods used for constructing buildings on permafrost are known as *active* and *passive*.

The active method of construction involves a major disturbance of the earth. The frozen earth is excavated and insulation placed below the frost depth. Fill is then placed above the insulation to form a proper base for the concrete work. Sometimes heating pipes are used in the fill space. This method is very expensive because of the difficulties of working in the frozen earth.

The passive method of construction involves a minimum disturbance of the soil. Buildings constructed by this method are generally built above grade placed on wood piles with conventional joists so as to allow a ventilated space between the heavily insulated floor and the earth. This precaution is taken to eliminate any thawing of the permafrost and consequent shifting of the foundations. The passive method is considered more practical in areas where permafrost exists to a considerable depth.

Many Arctic locations which do not have permafrost have solid rock at or close to the surface. The construction of conventional basements or foundations is extremely costly, if not impossible. Under such conditions, the passive method of construction is used.

The use of construction methods which leave a ventilated space below the floors results in uncomfortably cold floors (by our standards) unless some form of panel heating is employed. Design of panel heating systems for these buildings must minimize the reverse heat losses. Tests of panel systems with slabs on the ground by Professor A. B. Algren (HPAC, May 1948) have

TABLE 2—DESIGN DATA for Alaska

	Temperatures, F		Snowfall, in.		Design snow load, lb per sq ft	Annual precip., in.	Velocity wind pressure, lb per sq ft	Soil type	Seasonal frost depth, ft	Degree Days
	High	Low	Annual	High mo.						
Anchorage	84	−36	49	11	40	16	38	A	5	10,941
Fairbanks	99	−66	67	18	30	12	18	C	6	14,065
Whittier	84	−15	263	104	200	185	14	A, E	3	9,464
Adak	67	15	63	15	30	38	54	C	3	9,234
Nome	84	−47	60	11	30	17	21	Permafrost F	—	14,226
Point Barrow	78	−56	33	8	10	6	38	Permafrost F	—	19,974
Kodiak	82	−9	47	11	50	62	10	D	3	8,571
Juneau	89	−15	107	28	50	84	22	C	3	8,244
Ketchikan	96	−8	32	10	40	151	22	C	2	7,049
Seward	88	−20	73	17	100	68	14	A	3	9,387
Attu	70	10	67	16	30	24	41	C	2	9,702
Dutch Harbor	80	6	70	20	40	59	38	C	3	8,949
Tanana	89	−68	53	10	30	13	14	C	6	14,359
Valdez	83	−24	266	61	200	61	17	A	3	10,653
Eagle	95	−69	53	10	30	11	8	B	6	14,611

Soil types

A — Well graded sand and gravel — highly permeable
B — Gravel and silt
C — Fine silty sand overlaying coarse gravel or rock
D — One foot of volcanic ash over fine silts to coarse gravel
E — Solid rock near surface
F — Fine sandy silt

From Alaska Housing Authority Technical Div. Nov. 16, 1940.

shown back losses to be as high as 30 percent of the useful output of a floor panel. Without heavy insulation and good construction, this value would be exceeded when the panel is placed over a ventilated space as described for the passive method of construction.

Comfort in the Arctic

The evaluation of comfort for the Arctic is made difficult by variations in clothing and acclimatization. For example, a wide variation between British and American living habits with regard to these factors is well recognized. The general practice in the United States for many years has been to consider an air temperature of approximately 70 F as a standard for winter comfort when the normally clothed individual is at rest in a room with surfaces also near the air temperature. Of the several factors affecting comfort, the balance between the metabolic rate and the heat dissipation rate is of prime importance. It is known that for short periods of time the body can store heat in the event that the heat loss is less than the metabolic rate. Conversely, loss of heat can be more rapid than energy production for short periods. However, the necessity of this balance existing over long periods is well accepted as the basic requirement for comfort.

The metabolic rate is a function of the age and weight of an individual as well as the general degree of activity in which the individual is engaged. A value of approximately 400 Btu per hr has been determined from research for the heat production of a clothed person at rest in a room with still air at 70 F dry bulb, 45 percent relative humidity, and 70 F surrounding surfaces. The metabolic rate is known to increase during periods of increased physical activity and values of 2000 Btu per hr are reported for persons engaged in very heavy work. However, the above mentioned rate of 400 Btu per hr can be taken as a basis for design in calculations of conditions in living areas.

The total quantity of heat transferred from the body can be divided into three quantities — that transferred by radiation, by convection and by evaporation. The evaporative portion of the total heat transfer is approximately 100 Btu per hr under usual winter comfort conditions and is approximately 70 Btu per hr when air temperatures are below 62 F. The remaining amount (approximately 300 Btu per hr) of the metabolic heat leaves the body by convection and radiation. The division has been found by test to be about 100 Btu per hr by convection and 200 Btu per hr by radiation when the normally clothed individual is at rest in a room with 70 F air and 70 F wall surface temperatures. Apparently, it is not necessary for this division between convection and radiation to exist, for comfortable conditions, as long as the total amount is approximately 300 Btu.

Recent investigation in the field of panel heating has placed emphasis on the heat exchange by radiation between the occupant and the surfaces of the room with the point in mind that a reduction of radiant heat loss could also allow *lower air temperatures for comfort.* This possibility is of great interest in the Arctic building where the reduction in building heat load so accomplished would simplify the heating system and reduce the fuel requirements.

As reported in the September 1953 HPAC, an experimental investigation was conducted as a portion of a cooperative research program in which the effect of treating the interior walls of a test chamber (heated by a radiant ceiling panel) with reflective coverings was studied. These tests were conducted because of the belief that such reflective treatment would allow a great part of the radiant output of the panel to be absorbed by the objects within the room. The reflective surfaces reduced the heating load (for the same

TABLE 3—INSULATION VALUES of men's winter and summer clothes

		Winter season	Summer season
Average weight of clothes excluding footwear	lb	6.4	3.0
Air and wall temperature	F	72	80
Approximate relative humidity	%	30	55
Approximate air movement	fpm	20	20
Mean skin area of whole body	sq ft	20.3	20.1
Skin area covered by clothes	sq ft	16.2	15.8
Outside surface area of clothes	sq ft	19.7	18.6
Metabolic rate	Btu per hr	375	372
Moisture evaporated from lungs and skin	lb per hr	0.11	0.16
Average skin temperature under the clothes	F	92.8	93.8
Average outside surface temperature of clothes	F	81.7	88.0
Insulation of air computed from equation 5, HPAC, Sept., 1948, p. 108	Clo	0.84	0.82
Insulation of air computed from above data	Clo	0.83	0.83
Insulation of clothes by heat-loss method	Clo	1.02	0.71
Insulation of clothes by temperature-gradient method	Clo	0.87	0.56

From "Thermal Insulation of Clothing" by C. P. Yaglou, Heating, Piping & Air Conditioning, September 1948. Estimated by the heat-loss and temperature-gradient method from observations on a group of 22 men resting comfortably in air conditioned rooms

TABLE 4—INSULATION VALUE of wool-pile uniform (10.2 lb)
(Air and wall temperature 0 ± 1.5 F)

	Mean temperature, F			Clo values				
Area under observation	Skin under wear (t_s)	Inside pile surf (t_i)	Outside pile surf (t_o)	Under clothing (I_u)	Pile garment (I_o)	Total (I_t)	Pressure, lb per sq in.	Thermal sensation
Shoulder	82.6	53.5	11.6	1.8	3.0	4.8	0.00	cold
Chest	86.4	44.2	17.1	1.9	1.4	3.3	0.05	cool
Abdomen	88.8	38.1	14.9	2.5	1.3	4.0	0.02	cool
Back	86.9	71.3	23.5	0.5	1.8	2.2	0.25	cold
Low Back	87.3	37.9	18.1	2.1	0.9	3.1	0.30	cool
Upper Arm	78.4	50.3	10.6	1.9	3.1	4.9	0.05	cold
Elbow, bent	69.2	49.7	18.8	0.8	1.4	2.2	1.00	very cold
Forearm	73.3	56.2	17.4	0.7	2.0	2.6	0.15	cool
Jacket, wghtd. mean.	83.9	50.2	16.2	1.6	1.8	3.4	—	cold
Seat	77.4	69.4	59.6[a]	0.2	0.4	0.6	13.30	cool
Thigh, front	83.4	60.9	19.3	0.8	1.8	2.6	0.20	cool
Thigh, back	80.1	63.6	22.2	0.5	1.7	2.0	0.10	cool
Knee cap	68.9	48.7	17.6	0.8	1.5	2.3	0.75	cold
Shin	73.5	43.1	12.7	1.7	2.0	3.6	0.00	cool
Calf	70.5	38.3	9.1	2.4	2.6	5.0	0.00	cool
Trousers, wghtd. mean.	77.0	55.1	17.6	0.9	1.8	2.7	—	—
Jacket, and trousers	80.5	52.7	16.9	1.2	1.8	3.0	—	cold

From "Thermal Insulation of Clothing" by C. P. Yaglou, Heating, Piping & Air Conditioning, September 1948. Computed from simultaneous observations of temperature gradients. Skin area under the uniform 17.2 sq ft. Outside surface area of uniform 22.6 sq ft. Insulation of air 1.0 Clo
[a]Temperature of trouser seat in contact with chair. Equivalent trouser seat temperature in contact with air = 24.9 F

air temperature) approximately 25 percent, at the same time increasing the readings of various radiation measuring instruments significantly.

The work of Dr. Mills at "Reflection Point" (HPAC, December 1950) gives a comparable report of the value of reflective wall surfaces in rooms where a large amount of energy is released by radiation. The use of reflective wall treatment need not be confined to buildings in the Arctic. The advantage, however, appears to be particularly useful in this application.

Insulation of Clothing

Differences in clothing have a definite effect upon the indoor temperature required for comfort. At this point, the engineer should determine the type of occupancy, particularly whether the building is to be occupied by civilians or military men.

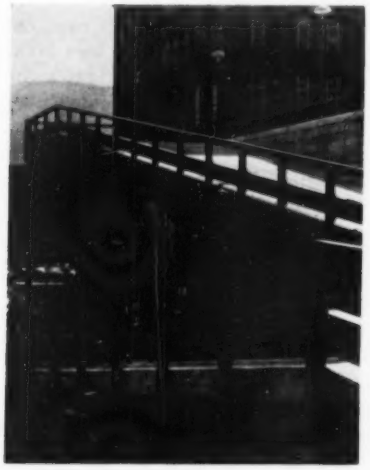
Experiments carried out for the armed services by Professor Yaglou (HPAC, September 1948) on the effect of clothing insulation are valuable as a reference on cold weather clothing. A unit of insulation value, the "Clo," has been used as an evaluation comparable to the usual units of heat flow resistance. One Clo unit is equal to a resistance of 0.88 F per Btu per hr per sq ft. Therefore, clothing with 1 Clo rating would allow 1 Btu per hr per sq ft to flow for each 0.88 F difference in temperature from the inside surface of the clothing to the outside surface.

Data from Professor Yaglou's studies are presented in Tables 3 and 4. From Table 3 the insulating value of normal winter clothing by the temperature gradient method is 0.87 Clo, and that of air from test results is 0.83, giving a total of 1.70 Clo. Military winter under-clothing provided a rating of 1.2 Clo, as shown in Table 4, and the insulation value of the air is 1.0 Clo. The insulation of an indoor uniform, while not expressly known by the authors, would undoubtedly bring the total Clo rating to a minimum of 2.5 Clo. Therefore, the increase due to military winter clothing can allow a greater temperature drop through the clothing and as a result, a lower indoor air temperature.

In summarizing comfort requirements, it can be said that the designer of heating systems for the Arctic must select an indoor air temperature which will provide comfort for the occupants. If the indoor air temperature is to be lower than 70 F, the engineer must be satisfied that clothing insulation will be greater than normal or that a radiant environment will be provided which will effectively reduce body heat loss.

The authors wish to acknowledge the guidance given by Professors A. B. Algren and E. N. Kemler, both of the University of Minnesota Department of Mechanical Engineering, under whose supervision the overall research program was carried out. Material is in part from a cooperative research project sponsored by the United States Naval Civil Engineering Research and Evaluation Laboratory conducted at the University of Minnesota. An article in the September HPAC presented test results and discussed the use of reflective surfaces in building construction for maximum use of heat supplied to the structure.

Snow Melting Piping Keeps Garage Ramps in Use



OUTDOOR RAMPS serving the roof-top parking area and second story are "weather conditioned" by a snow melting system

NARROW STREETS and limited space for parking at Westinghouse Electric's plant in East Pittsburgh add up to a "modern age" congestion problem for visitors and employees.

Helping to solve the parking problem is a new three-story garage, engineered to accommodate four floors of cars. This is accomplished by an outdoor ramp which permits the use of the roof for parking.

To assure year around use of complete garage parking facilities, a snow melting system of wrought iron pipe coils and grids has been incorporated into the inclined driveway ramps and the roof.

For convenient entrance and exit, an individual approach serves each floor, including the roof. Direct off-the-street entrance is provided to the first floor, with the second, third and roof levels served from an alley in the rear of the garage.

The alley parallels the third story elevation and permits direct entrance. To serve the second floor, an "all weather" outside ramp drops downward from the alley, while another ramp leads to the roof parking area.

More than 10,000 ft of 1¼ in. wrought iron pipe is employed in the snow melting system serving ramps and roof.

In the 104 ft by 60 ft concrete roof flooring, pipe is laid on 12 in. centers. Ramp piping is embedded in concrete supported by metal angles. To serve the 210 ft of inclined driveway, approximately 2400 ft of pipe is required.

The piping of the snow melting system is covered by a 4 in. finishing slab of poured concrete. Heated water mixed with anti-freeze is circulated through the pipe network.

Stone & Webster designed the installation, and Sauer, Inc., was the piping contractor.

Statisticians Forecast School Building Boom

STATISTICS RELEASED by the Metropolitan Life Insurance Co. predict a boom in public school construction over the next seven years to meet the needs of the expanding younger population. According to the statisticians, nearly half a million more school children must be taken care of this year in the 12 north central states.

That is only the start of the increase. By 1960, the number of five to 13 year olds in the area is expected to increase from 7,378,000 to 9,125,000. High school students are estimated to increase from 2,572,000 to 3,315,000.

Schools for 8 million new scholars will be needed nationally over the coming seven years.

THE LAW AND YOUR PROFITS

When Is a Job "Satisfactory"?

LAW BOOKS devote substantial space to the definition and re-definition of "words and phrases". The average layman, no matter how well versed in his own specialty, is likely to be overtaken by a squeeze-play if he is unfamiliar with the *legal* meanings of apparently commonplace words. Heating, piping and air conditioning contractors are no exception, as a recent court decision shows.

Edgar Finefellow [the names herein are imaginary] contracted with the Chill-Lee Co. for the purchase of a cooling unit and its installation at his place of business. The retention-of-title contract contained a guarantee clause substantially as follows:

"This cooling system will be installed complete and fully satisfactory. Unit guaranteed five years; motor, one year."

A 10 percent cash payment was specified, the remainder to be paid in agreed installments. The Chill-Lee Co. assigned the contract to its bank, which collected the time payments from Finefellow as they fell due. However, that gentleman had in some manner obtained the installed unit without making the down payment. When months rolled around and this was not forthcoming, Chill-Lee sued Finefellow in civil court.

Finefellow filed an answer setting up "total failure of consideration". The unit, he contended, was installed by Chill-Lee for the purpose of cooling his business establishment; but, said he, it had never fulfilled this function. As evidence he introduced repeated thermometer readings on days when the temperature outside was 97 to 100, showing that the inside temperature was never more than 2 or 3 deg cooler, was sometimes the same, and at other times actually higher.

The case got to a jury, which on evidence returned a verdict against the Chill-Lee Co. and in favor of Edgar Finefellow for the full amount of the contract, less the 10 percent down payment he was supposed to have made. Chill-Lee appealed to a higher tribunal.

The court of appeals, in its opinion on the case, re-defined the words "guarantee" and "satisfactory" as appearing in the contract. "Guarantee" in a contract of sale must be construed to mean "warranty" because this was "the obvious intention of parties", the court declared. "Warranty" — whether "express" or "implied" — is a very strict term in legal lingo. Plainly speaking, it's an assurance that the thing sold or installed is all right and works all right.

Hence, the word "satisfactory" in the Chill-Lee contract with Finefellow meant that Chill-Lee *warranted* the equipment to be satisfactory *for the purpose intended.*

Affirming the trial court's decision against the contractor the higher tribunal handed down a general statement of law which should prove useful. In simple English, it said:

Where the seller of an air cooling unit (or other equipment) installs it in the buyer's place of business and "fully guarantees" both motor and unit "to be satisfactory" for one and five years, respectively, there is *express affirmation* of an implied warranty that the whole mechanism is reasonably suited for the purpose intended.

In support of this view, the appeals court cited other decisions — notably, one involving purchase of a dynamo which, when installed, generated current but not of a sort adapted to electric lighting. Here, though the seller does not seem to have mentioned illumination in his sales contract, the law made him "impliedly warrant that the generator was suited for generating light."

Our subject case is particularly instructive as to the use of a term much bandied about in business discussions and agreements — the word "satisfactory". From Chill-Lee's fate, we learn that this word, far from possessing any qualities of double-talk, is legally loaded. The law construes it strictly and reads into it a broad embracement. The buyer's purpose and intentions are all taken into consideration. It is not basically necessary for the buyer to prove any kind of mechanical or other defects. He simply shows that the equipment does not perform in a manner *satisfactory to him.*

Reverting to Finefellow's case, the failure may have been his own fault, so far as the evidence indicates; or perhaps on the other hand, the layout was not properly engineered before installation. In any event, Chill-Lee himself was not prudent when he went ahead with the job before receiving the down payment.

By way of contrast, another legal aspect of the word "satisfactory" is revealed through a decision in another state. A contracting firm installed a heating and ventilating plant in a public school. The job was accepted in writing as "satisfactory." During the subsequent winter the plant was operated by the school, which claimed that it did not function so as to heat the school to 70 deg in the coldest weather, as was stipulated.

Litigation resulted in a lower court judgment for the school, but this was reversed by the state supreme court, which held that the school authorities, having accepted the installation as satisfactory to themselves, were saddled with the burden of proving lack of proper operation.

[Note: While this discussion applies to actual cases, it should be remembered that legal rules vary in different states.]

William Hurd Hillyer, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

QUESTION OF THE MONTH

• *A CONTROVERSIAL question asked by a reader some months ago requested comment and opinion on whether to use a "conventional" boiler or a packaged boiler-burner unit. Several replies to this question have already been published, and another one appears this month. Further comment and "experience data" will be welcomed.*

Use Packaged or "Conventional" Boiler?

I HAVE BEEN following with great interest the answers published in HPAC on the question of packaged vs. conventional boilers.

The conventional units — cast iron sectional or steel firebox — require more headroom due to the refractory setting, or a pit. No such headroom is required by the package boiler. On the other hand, such a unit is slightly longer than the conventional boiler. Most consultants will agree that it is a simple matter to provide an additional foot or two in the boiler room for length.

One of the published comments said that life expectancy of the package unit is an unproved question. There are units installed over 15 years ago and which are still operating. The units are in excellent condition and it is expected that they will give many more years of service. In estimating life expectancy of boilers, it must be remembered that experienced engineers base their estimates on "normal" maintenance. This estimate rarely takes into account the fact that a great many individuals fail to follow manufacturers' recommendations and as a result fail to obtain maximum equipment life.

Some manufacturers of packaged units can guarantee at least an 80 percent fuel to steam efficiency throughout an operating range of from 30 percent to full boiler output. This figure can easily be obtained even with a boiler which has been operating for over a year.

Many engineers and prospective buyers want to know what over-ratings are available from package units. It doesn't seem entirely logical to select a boiler for a given load and then contemplate overloading it. For every plant, a given steam or hot water load can be calculated. It would seem that equipment should be selected to carry this load. Should future expansion be contemplated, it can be taken care of by either sizing the initial equipment to carry such future load or by adding additional equipment.

In the former case, generally the boilers can be a multiple installation so that equipment can be rotated in operation.

Regarding the cost of operation, large savings are available through the use of package equipment. Such units have the burner and boiler designed for each other so that the burner and boiler work at optimum efficiency and the automatic adjustments to produce lower output do not change this.

Maintenance of the package boiler under proper operating conditions is not — as believed by some — excessive. With the proper attention to feedwater treatment, blowdown schedule, burning of fuel and (above all) properly sizing equipment, maintenance costs are kept to a minimum. Improper operation and attention are probably the greatest causes of high maintenance costs. It must be admitted that you cannot secure full life expectancy of any equipment without proper maintenance. Since this maintenance costs money, it is a factor to be considered. Costs for the package unit average approximately 60c to $1 per boiler horsepower, depending upon the size of the unit.—V. A. STARACE, Mechanical Engineer.

READERS ASK —

1 What Absorbs Movement of Heating Risers?

"In a steam or hot water heating system, especially in high buildings, the movement of risers up and down is absorbed in the connections to the radiator (or convector). This is the usual '3 elbow' connection, ordinarily ½, ¾ or 1 in. pipe, as per Fig. 1. How is this movement absorbed—by the threads of the fittings turning or by the pipe between elbows bending? What is the minimum length of "A" in relation to riser travel?

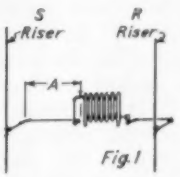


Fig. 1

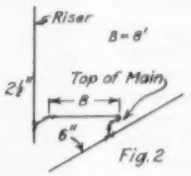


Fig. 2

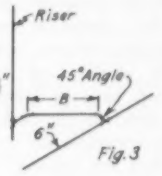


Fig. 3

"Take larger pipe. We have a 6 in. steam main in the basement with 2 in. and 3 in. branches to the bottom of risers. These branches are, say, 8 ft long, taken off the top of the main or at a 45 deg angle, the bottom of the riser having a tee, nipple and elbow as per Figs. 2 and 3. Does the pipe "B" bend or do the fittings turn on their threads?

"I have asked this question of dozens of competent and experienced men. Half say the threads turn. The other half say the pipe bends and that, if the fittings turned on their threads, you'd have a leaky joint in short order.

"Does anyone have conclusive proof of what actually happens, gotten by accurate observation under job conditions?"

2 Cost of Reheat Compared With Bypass?

"We would appreciate any information on the following two questions. Either references to published data or suggestions from HPAC's readers would be most helpful to us.

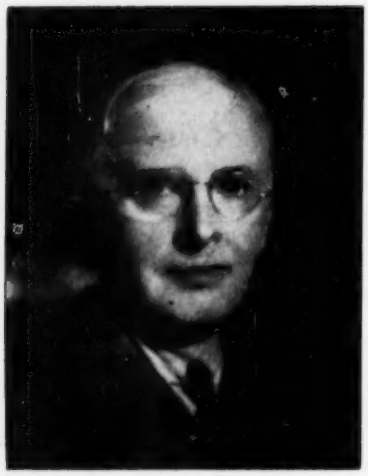
"a) Cost of operation of a "reheat" air conditioning system over that of a conventional "bypass" system.

"b) Operation and installation cost of air cooled condensing units versus water cooled condensing units in the 5 hp size or less."

[You are invited to comment on these questions, giving actual examples if possible. Address the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2].

SAM LEWIS' PAGE

"Too Little Engineering Spoils the Broth"



SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems. He describes the badly mixed up ventilation arrangements for a large hotel's kitchen and laundry, tells how this sick job was corrected

ACCORDING TO THE old saying, "too many cooks spoil the broth." Perhaps it should also be said that too little engineering attention spoils the air conditioning in the place where the cooks do their work. A recent job on which I was called as a consultant exemplifies the sort of trouble which must be corrected to improve comfort, efficiency and good employee relationships.

A very large and "aristocratic" hotel, which is famous for its food service, has several kitchens. The principal one is in the basement, with wide but not very long stairways giving access to the main dining room. There are more than 50 linear feet of continuous cooking ranges, as well as the usual steam and gas tables, pastry ovens, dishwashers and other heated appliances. A reasonably effective hood above the ranges is connnected to a 200 ft shaft that leads to an exhaust fan. This fan has a 25 hp motor that was doing a 10 hp job.

There is an air supply duct parallel with and adjacent to the range exhaust hood. This supply duct has down-discharging air diffusing outlets at intervals of about 8 ft. This air is intended to cool the cooks by delivering air from out-of-doors on top of their heads and shoulders.

No means was provided for controlling the temperature of this new air. Obviously, its temperature must go through a very wide seasonal variation. It could not be endured in extremely cold weather unless greatly reduced in volume, and in hot weather unless the volume was prodigious. Each cook does have available near his station a manual control for air volume.

There is a supply fan placed about 100 ft from the ranges. There is no way for the cooks to know whether this distant supply fan or the exhaust fan are operating.

112 Deg, 92 Percent

On a normal 78 deg summer day I found the general kitchen temperature in the 90's, alleviated at one zone only by a considerable volume of air that was entering through the stairway from the air conditioned main dining room. The temperature in front of the ranges, under the air supply duct, was 112 deg and the relative humidity at the entering air stream was 92 percent. It was stated that both the supply fan and the exhaust fan were in operation, and that this temperature condition — while not pleasing — had been prevalent over many years.

The hotel has a big laundry, with modern washers, dryers, ironers, etc. It is at the same level as the kitchen. Like all good laundries it must use a lot of heat — especially for the ironers — and it has hoods and ducts and exhaust fans.

During each hot summer for years, influenced by ever-increasing business, more exhaust fans had been added so as to try to retain the services of the faithful but ever-suffering employees in the laundry.

There has never, however, been any attempt to provide a supply of air at any controlled temperature or volume to replace the hot, damp, lint-laden air that the exhaust fans endeavor to remove. I like to arrange for replacement of what I take out.

The laundry — unlike the main kitchen — has windows and of course they are opened during every hot day. I found the laundry in full operation, with all windows open and all exhaust fans running. I found all doors to the laundry (including the truck-way doors to the kitchen corridor) wide open. Hot laundry air was flowing into the kitchen via the corridor.

The laundry exhaust fans, for about half of the room, discharged the heated air into the same narrow little court from which the air supply fan for the main kitchen drew its only supply. The humid and overheated laundry waste air was therefore flowing directly into the kitchen supply fan intake. I inspected the intake chamber of this fan. The housing, and the walls and ceiling and floor of the room, were coated with black dust mixed with lint from the laundry, all of which of course was being delivered by the kitchen supply fan into the food served in the famous main dining room.

I found another exhaust fan in

the basement that had been designed to help cool the laundry. Its outlet duct ran some 100 ft to a vertical shaft 14 stories high where it terminated in half-rotted metal louvers, looking through a wall against the wind. In remote history, some engineer had added a second exhaust fan on the 14th story, hoping that it would assist its friend, down in the basement, by picking up the laundry air and pushing it along.

More recently, it had been decided that this 14th story booster could be better occupied by helping the kitchen exhaust fan and so a bypass suction duct had been connected to it.

Thus, the original kitchen exhaust fan and this smaller, different laundry booster exhaust fan both tried to pull air from the same basement kitchen using the same duct. Each fan motor occasionally would overload — as is the well known custom of such fans — and fuses would be blown. The exhaust fan for the laundry, in the basement, now deprived of the help from its booster friend on the 14th story, and deprived of any outlet to the sky, made complaint.

A "genius" in the organization thereupon cut an opening in the outlet duct from this fan so as to relieve the fan. The hot, damp, lint-laden air thereupon found its way directly back into the laundry through the open door, as well as into the kitchen through doors in the corridor.

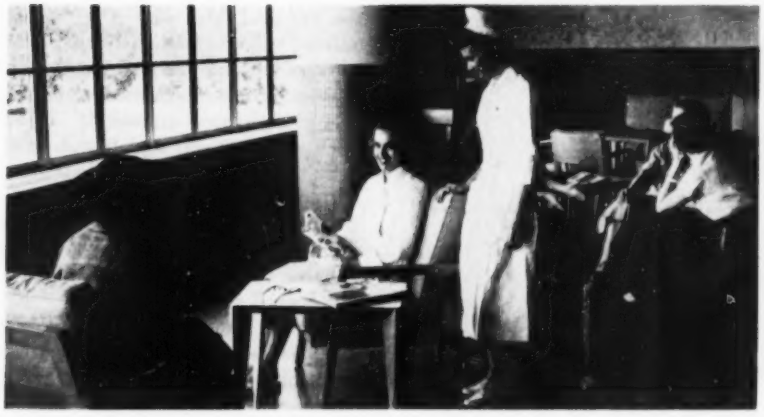
How Set-Up Was Changed

Of course we changed the set-up immediately, first by a house-cleaning of the kitchen supply system. This was followed by adequate and accessible filters for this system, and by means for tempering the air. We compelled one fan, only, to serve the range hood duct and we utilized the former laundry booster fan to remove more warm air from the kitchen via a separate duct.

We gave the laundry exhaust system a free and vertically discharging outlet to the atmosphere at a spot remote from the court of the kitchen supply fan inlet, and we made that court a space devoted forever to kitchen air supply exclusively.

I am in favor of having more of the good hotels of the country call in some one periodically to refresh their operation. I shall not forget the lessons of this experience when I design my next hotel installation.

Air Conditioning a "MUST" for Some Heart Cases



MEDICAL SCIENCE is re-emphasizing the fact that proper air conditioning is not only a factor in comfort and high industrial and business productivity, but is sometimes essential to health.

Research by a grantee of the U. S. Public Health Service has indicated — and the American Medical Association has concluded — that some cases of heart disease require that patients should have air conditioning in their rooms or hospital wards during hot, humid weather.

An investigation conducted under a grant by the National Heart Institute of the Public Health Service disclosed, for instance, that people with congestive heart failure cannot tolerate excessively warm atmospheres.

Observing patients in controlled rooms, it was found that during a change from 73.4 F and 60 percent relative humidity to 104 F and 85 percent, symptoms and signs of left ventricular failure of the heart developed in 10 out of 12 subjects. These were people known to have slight congestive failure. Because of these signs — which included shortness of breath, inability to breathe except in an upright position, apprehension, and cardiac asthma — the experiment had to be discontinued. It was demonstrated, however, that exposure to a hot, humid environment in the case of persons with cardiac disease and diminished cardiac reserve may precipitate acute ventricular failure.

In application to the general population, it may be noted that some nine to 10 million of our people in the United States are estimated to have some form of heart disease, and many do not know they have it. While the encouraging fact is that 15 out of 16 of us *do not* suffer from ailments of the heart and blood vessels, those who do constitute a sufficient number to make air conditioning often an important measure.

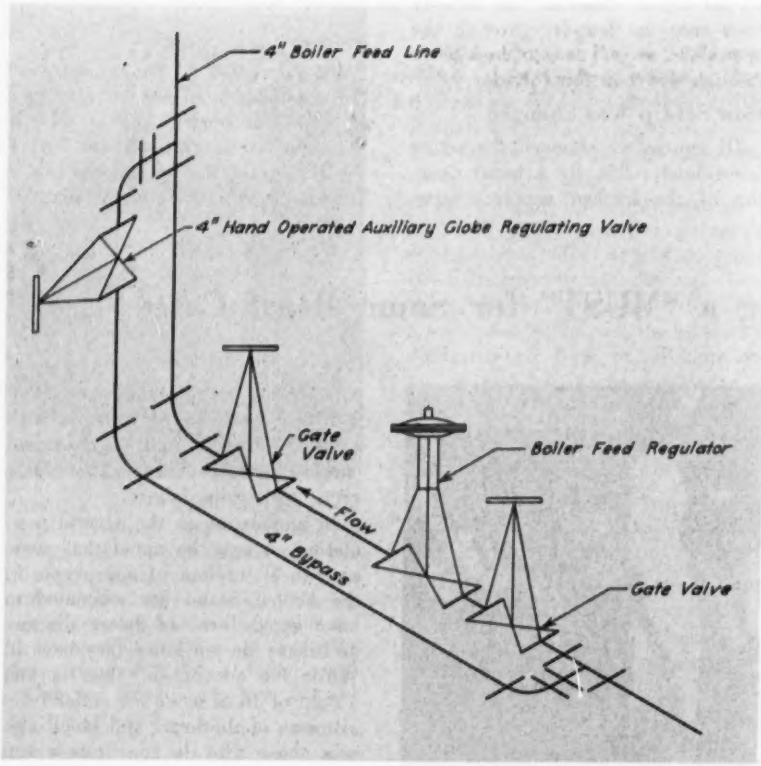
The AMA noted in a recent journal it publishes that the best guide for adjusting the temperature and humidity of a patient's room is his comfort. The reason that people with heart disease should have air conditioning is that as the temperature and humidity go up, the heart must increase its efforts to cool the body through increased flow of blood through the skin.

The skeletal muscles of the body may be rested as a person lies in a warm bed in a warm room, but the heart has to work much harder. Rest in bed in an air conditioned room, however, rests the heart, the AMA says.

ANYTHING CAN HAPPEN

"You Learn Something Every Day"

How To Open a Stuck Valve



"THE BOILER FEED REGULATOR is giving trouble and the auxiliary hand-feed regulating valve is stuck closed. Nothing left to do but pull that boiler out," said Jerry.

By Bill Dopp

• *Almost anything can happen when you're in the engineering, operating, contracting or sales ends of the heating, piping and air conditioning industry. The objective of this more-or-less regular editorial feature in HPAC is to discuss practical problems that need solving — and ways to solve them.*

Bill Dopp has had 40 years of experience dealing with piping, including a long stretch of service as a sales engineer. He is devoting some of his present leisure to drawing on his many piping experiences, as he does in this story . . . .

"HELLO, MAC." Jerry Davis had a listless tone as he greeted the gasket salesman from the door of the elevator in the power plant lobby. "Better not try to see the old man today."

"Why? Something wrong?" asked Mac.

Regulating Valve Stuck

"The old boy is chewing nails. We've got to shut down the big boiler. The boiler feed regulator is giving trouble and the auxiliary hand-feed regulating valve is stuck closed. We can't budge it. Nothing left to do but pull that boiler out. I'd stay far away from Bill Stuart if I were you."

"This sounds interesting," replied Mac. "What kind of a valve is it?"

"I'm going up there now. I'll show you the valve. If you see Bill coming you'd better duck," Jerry laughed. "He isn't going to like my letting you in on his troubles." When they got to the door marked '4' the elevator stopped. They stepped out onto a long pipe gallery. Near the far end Mac saw a group of valves. There was the usual diaphragm top boiler feed regulator with a gate valve on each side of it and the pipe bypass around it. The hand regulator was a globe valve the same size as the boiler feed pipe. All of the piping and valves were covered, and were painted a pale blue.

"That's a 4 in. line, unless I miss my guess," remarked Mac.

"You're right," said Jerry. "And boy, is she stuck. We've tried everything to get it open, but there she is, still closed and grinning at us."

"It's closed all right, and I'll agree that it's stuck." Mac returned as he tried to move the handwheel. "What would Bill do if you and I opened that valve for him without his knowing anything about it?" Mac was chuckling to himself but Jerry looked scared.

"Gosh no! I'd get fired right now and you'd get booted out of here with orders never to come back." Jerry put his hand on Mac's shoulder. "Do you really think that the valve can be opened without shutting down?"

"I think it can." replied Mac. "In fact, I'm sure of it. I wonder if Bill would listen to me?"

"We can try," said Jerry doubtfully. "Here he comes now."

Bill Stuart gave Mac a jaundiced look and turned sharply to Jerry, "What's he doing here."

Jerry had to do some quick thinking. A bright thought struck him, so he said, "I thought Mac could tell us whether it was the stem packing that is holding that valve. When I saw him come in, I asked him to look at it."

"The packing's got nothing to do with it," said Bill emphatically. "It's the valve. These people never did know how to make a globe valve. Wait until I tell them what I think of their product." Turning to Mac, he continued, "We've just got to shut down this boiler tonight to get that valve open."

"Not unless you want to, you don't" said Mac.

"What do you mean, unless I want to?" Bill's temper was rising fast.

"Will you let me try to open that valve for you?" asked the smiling Mac. "I think it can be done in an hour or so with Jerry's help. I'd like to try."

"You can't budge it with a lever," barked Bill. "We put all of the force that we dared on it. That line is full of hot water at more than 1100 pounds pressure and around 400 degrees temperature. We can't take a chance on opening that up. Somebody would get killed if it let go."

"There are different kinds of force, Bill. Can I try? I'll be careful." Mac's eager attitude nearly made Jerry laugh and seemed to persuade Bill.

"How you going to do it?", he wanted to know.

"Stick around and you'll see something," replied Mac. "Jerry, can you get hold of a couple of pounds of dry ice? We'll need two small blow torches, too."

"I can get the dry ice across the street," said Jerry. "It won't take long." He started on an eager run.

"What the devil are you going to do?," demanded Bill. It was evident he didn't wholly trust this placidly confident salesman.

Expansion Locks Valve

"Bill, the thing that has locked this valve is expansion. Did it occur to you that when this boiler feed line was filled, this valve might have been closed? As I see it, that is what is wrong here. Since the valve is exposed to water on both sides, if it was closed cold, the hot water has caused the stem to expand. You can get a terrific load on that bridge wall and yoke sleeve. In fact it can get high enough to break down the bridge wall."

"Holy mackerel!," exclaimed Bill, "If that valve was closed when we filled the line, with water at say 70 degrees, and it's now around 400, I suppose that all of the slack has been taken up."

"You can have a load of tons on that thread," declared Mac. "It's a good valve that can take that sort of thing and not give up the ghost. The threads in that bronze yoke sleeve may be injured, at that."

"I see now what you intend to do. Here comes Jerry on the run with the stuff. Fast work. What else do we need?" Bill offered complete cooperation.

"Let's see if we can find some sheet asbestos and some wire. A pair of leather gloves will help, too. I'm going down to the locker room and see if I can borrow a jacket." Mac started toward the elevator.

"I'll go with you," said Bill. "Jerry, will you see that everything we need is ready? We'll be back presently." As they walked along, Bill put his hand on Mac's shoulder. "Mac," he said, "this is going to save us a lot of money, if you can do it. We'll sure be grateful."

"Let's wait and see. No use counting our chickens yet. They may not hatch." Mac obviously wanted to hedge his bet.

"You know, it never dawned on me that this valve might have been closed when we started that boiler. Up to now we have had no occasion to open it, either. I hate to think what that stem is taking in the way of a compression load." Bill seemed to be thinking out loud.

"We don't know how tight that valve was closed," observed Mac, "and maybe the slack was backed off. It would take a magician to figure out the load on that stem. All that we can do is to try to shorten it. It won't take long to find out if our scheme will work. We will have to watch our step, though, or there may be other trouble."

Bill looked at Mac sharply "What do you mean, other trouble?"

"That valve looks pretty big to me. I don't know who designed this line but it seems to be heir to a very common mistake in sizing these hand operated regulating valves." Mac had found a pair of overalls. "May I use these?" he asked.

"Sure, go ahead," replied Bill. "Now about that valve. Explain yourself."

Valve Size Important

"Well, as a rule the size of a pressure regulator is deceiving. They carry the size of the pipe line that they are used in, but actually the seat opening is much smaller. I'll bet that the effective area of that regulator is not much over 2 sq in. They get high velocities and resulting high pressure drops through those things. Regulation at low loads is the difficult problem. It's what gives the trouble with the hand operated regulating valves, too. If that valve of yours is a 4 in. valve, the area of the seat ring is probably somewhere around 10 sq in. It's a plug type valve, I presume?" Mac's question brought Bill out of deep thought.

"Sure. We don't use anything else around here. Go on with your story." Bill had Mac cornered in the locker room and proposed to get all the information he could before letting him go.

"If a 10 in. area will handle that steam load on the boiler going full tilt, it will take only a very small area to handle the low night load. How close do you suppose you are going to have to throttle a 4 in. valve under low load conditions?"

"Why, we'd barely have to crack it open, in that case. Wow! Will that baby chatter?" Bill was genuinely concerned. "Mac, did you ever hear a plug type globe valve really get to chattering?"

"You bet I have," answered Mac, "I've seen them nearly wreck a pipe line. That's just what I had in mind when I spoke of trouble." Mac smiled. He and Bill seemed to be getting along okay. "Now let's get back to Jerry and our valve," he said as he started for the door.

When they got to the pipe gallery where Jerry had assembled a lot of gear Mac looked it over and asked, "Jerry can you get me a drift, a long one; and a couple of machinists' hammers?"

"Sure." He turned to an assistant, directing him to bring the tools. "What do you want those for?," he asked Mac.

Dry Ice and Drift Used

"I've got a hunch. We may need them. We'll see." Mac studied the valve, installed in a vertical line, the stem being horizontal. "Looks as though we could cover about 2½ in. of stem with this stuff," he said, pointing to the pail full of dry ice. "Let's make a trough of that asbestos and fill in the snow. Be careful, that stuff burns!," he warned. They got the stem packed and the asbestos wired around it. Mac stood back to survey the job. "That will do for the present," he said. "Now let's wait awhile. That stem will take time to cool."

"How much do you think it will shorten the stem?" asked Bill.

"Who knows," replied Mac. "It's anybody's guess. We don't know how much the stem lengthened and we could only guess how effective the cooling will be. We have a couple of more aces up our sleeves, though, if this doesn't do the trick." Mac turned to the other fellow. "What's your name?" he asked.

"John," the fitter replied.

"All right, John, you and Jerry get hold of that handwheel and keep a steady pressure on it in the opening direction. Don't jerk. Just a steady load."

John and Jerry started to apply all the force that they could. Nothing happened. After a few moments Mac picked up the torches and lit them. When he had a good flame, he applied one torch to each side of the bare yoke. It took a while to heat the metal. Suddenly the handwheel moved. It was only a slight movement but it did show progress. Mac set down the torches. "Jerry," he said, "let's get some penetrating oil on that thread. I think we are going to get this valve open pretty quick."

Jerry got the oil. In a short time they were ready to try again. Mac stood eyeing the drift that lay on the floor. He picked it up, deliberately bored a hole through the covering near the center of the valve, left it sticking in the hole.

"Bill, you handle these torches," Mac suggested. "Now fellows, put on the beef! Steady!" Mac watched the proceeding carefully. "A little closer with those flames, Bill," he said, as he picked up a husky hammer. "See if you can turn that stem back, Jerry."

The torches were making things hot and they were all sweating. The stem moved back a bare fraction of an inch. "Now open her," shouted Mac as he hit the drift a series of hard sharp blows. "Give her all you've got, boys. There she comes. It's about half open, Jerry. That's enough!" Mac was grinning and all the rest were shouting.

"Grand work," exclaimed Bill, as he slapped Mac on the back.

"Better close that valve, Jerry," cautioned Mac, "or you'll flood that boiler. Not down hard, until we get that dry ice off the stem and give the whole works a chance to get back to normal temperature." Even Bill pitched in to clear the valve.

"I didn't think it could be done," he said to Mac. "This gets us out of a tight spot, all right. I'm still concerned about what you said regarding the size of the valve."

Before Mac could answer, Jerry interrupted with a question. "What did you tap on the body for, Mac? I thought you were going to drive that drift right through it."

Use Reduced Seat Diameter

"I had a hunch that the disc was stuck in the seat ring. You see, when two metals have been forced into close contact under heavy pressure they have a tendency to knit together. All I did was to set up a vibration to break the disc loose." Mac took Bill's arm as he spoke. "There is danger of serious trouble, Bill, if you throttle that valve very close. The size of the seat in the bypass should not be too much larger than the area of the regulator itself. It is good practice to use a seat about half the size of the nominal valve size. In other words, use a reduced seat diameter in the regular size valve. That permits regulation at low loads without getting the disc so close that vibration starts, or getting excessive turbulence when the valve is wide open."

"The regulator is in bad shape. We will have to service it. What can we do about this valve in the meantime?" Bill had completely changed his attitude toward Mac.

"Not much," replied the gasket salesman. "Just be extremely careful when you use it. I'd call in your engineer and the valve people. See what they recommend. Between them they should be able to work out a satisfactory solution that will avoid future trouble. Then when you have the boiler down the next time, you can install one of the more modern auxiliary regulating valves." Mac looked at his watch. "I'm sorry, Bill, but I've got to get going. I'll see you soon." He waved to the group as he hurried on his way.

Bill turned to the others. "Of all things, to solve a problem with dry ice," he said, shaking his head. "You can learn something every day."

Plans Heating Oil Storage in Old Slate Pits

PLANS LOOKING toward the adaptation of abandoned slate pits in northeastern Pennsylvania as underground reservoirs for the seasonal storage of heating oil are being considered by the Esso Standard Oil Co.

"The successful, economical operation of these reservoirs," said William Naden, of Esso, "could mean the eventual utilization by the industry of the vast natural storage capacity that exists in many parts of the country. It could also mean a big step toward the practical solution of the problem of uneconomical peaks and valleys of seasonal refinery production and product transportation."

The storage operation would be carried out by removing water from the bottom of the pit as oil is pumped in at the surface. To insure that the water pressure on the walls of the pit would always be greater than the pressure of oil, the oil level would be held below the level of the surrounding water table. Any leakage would then be in the direction of water into the pit. Water seepage would be periodically pumped from the pit as necessary to keep the oil level below the water table.

When oil was to be removed in the heating season, the procedure would be reversed and water pumped into the pit below the level of the oil. This requires the use of a second quarry as a water reservoir to supply water to displace the oil and act as a safeguard against oil bearing water being pumped into natural streams and causing a pollution problem.

DATA SHEET

Facts About Sound Levels for Axial and Propeller Fans

WHEN WE SPEAK of noise, we refer to the effect upon the human ear produced by a sound. We realize that the human race shows a wide variation in eyesight, character, brain power, physical developments, etc., between individuals and we therefore know that the effect of a specific sound upon individual ears may produce varied reactions.

Fan Noise — What Does It Mean?

A sound or noise may be said to contain both character and intensity. By character, we refer to the quality of the noise, a factor involving pitch, frequency and pulsation. By intensity, we refer to the power or loudness of the sound, a factor which is dependent upon the power output of the object generating the sound.

Sound or loudness level is determined by sound level meters which give the sound intensity level directly in decibels above the threshold of hearing. The sound intensity level represents the meter pick up by microphone and not by ear. One decibel is the minimum change in sound intensity which the average ear can recognize.

At present there are no codes for measuring the character or quality of sound as it produces annoyance to the human ear. As two musical notes struck simultaneously sound pleasant when they harmonize, but are quite annoying when discordant, so too the character part of the noise made up by the base frequency and harmonics is often more annoying to the ear than the loudness produced by the sound intensity.

Total noise developed by an axial or propeller fan is dependent on power output for intensity, plus vortex noise resulting from oscillatory acceleration of air and rotation noise caused by the pressure field surrounding each blade. Dependent on fan design, number of fan blades and revolutions per minute, the rotational noise is usually the bad actor responsible for complaints regarding fan noise level.

Inherent fan noise may be modified by the ambient noise level of the room where the fan is installed. Distance from the human ear, reflecting or sound absorbing qualities of the wall, ceiling or floor surfaces, sound insulating mounting, obstruction to or restriction of air flow are all factors involved in the acceptability to the ear of fan noise under operating conditions.

It is the purpose here to present a condensed version of existing methods of measuring sound comparisons and to point out that unfortunately they do not provide for measuring and rating on a basis that judges the acceptance standards of the average human ear. Research in progress may develop a more practical method for noise specification which will include a character or annoyance factor evaluated with sound intensity.

Measuring Fan Noise

A committee of the American Society of Heating and Ventilating Engineers is engaged in compiling data with the object of eventually drafting a code for sound measurement of fans.

The U. S. Navy has a code for sound measurement of fans as generally applied for shipboard use. The National Association of Fan Manufacturers has published a code similar to the Navy's.

The Navy or NAFM code procedure requires sound level readings at each of seven stations spaced at 5 ft from the outside of the fan housing, and located in a horizontal plane passing through the fan shaft. The sound level of the fan is the average of the seven readings. These readings are the overall sound as measured by flat response without network on a sound level meter registering sound intensity or pressure by microphone pick up. Such readings are expressed in units termed decibels.

The limitations of the NAFM code covering centrifugal and axial fans are clearly set forth as follows:

"The purpose of this code is to provide a commonly used method of sound determination to give designers and users a relative idea of sound conditions.

"The sound that is emitted at the fan outlet and carried through the duct system is not determined under this code, since there is no known means at present for measuring the sound level in an air stream. In general, a fan with a higher ambient sound level will have a greater sound level in the air stream, but its exact amount is not measurable under the present state of the art."

In commenting on the NAFM code, the ASHVE has published in the Heating, Ventilating, Air Conditioning Guide the following remarks:

"The level so determined is valuable primarily for *comparative* purposes rather than absolute values. Of more value to the engineer would be the sound level at the fan outlet and at the beginning of the distribution duct system."

Room and Building Noise Levels

The 1953 Guide published by the ASHVE has the following comment:

"Measurements of sound levels in various types of rooms and locations have been observed by numerous investigators. However, close agreement upon these values has not been realized, and more detailed measurements are needed to accurately establish the normal sound levels in occupied spaces and enclosures subject to sound analysis and control."

This material has previously been published in bulletin form by the Propeller Fan Manufacturers' Association.

Some investigators have obtained their readings of sound levels on the basis of the 40 db or 70 db network. Others show sound levels on the basis of flat response without network.

The U. S. Navy or the NAFM code for sound measurement of fans reports sound level readings on the overall sound as measured by flat response without network.

In general, levels taken upon flat response without network will be from 5 db to 20 db higher depending on frequency and intensity than those obtained by means of the 40 db or 70 db network.

Generally, investigators are in agreement that it is not desirable to specify equipment sound levels above the acceptable space or room level in which the equipment is installed.

Sound Specifications — Can They Be Rigidly Drafted?

In the present state of the art, where many factors are unknown, exact sound specifications for either room, building or equipment are not possible. At best, such specifications can only be approximate.

Currently, a number of groups are engaged in further research on sound measurements and sound levels but complete data is not now available.

An example of the lack of instruments is one which will measure sound in a moving air stream of appreciable velocity. This lack has caused the codes of the U. S. Navy and the NAFM to determine sound measurement at points outside the fan housing. Yet it is generally known that the sound level in the air stream will be higher than the ambient sound level, but the exact amount is not known.

Lack of agreement among investigators on normal sound levels in occupied spaces and enclosures provides a further handicap in preparing exact specifications. In some cases, published sound levels for rooms and buildings fail to state whether readings were taken on the basis of 40 db or 70 db network, or flat response.

If sound specifications are required, recognition should be given to the limitations existing as to room and building noise levels as well as to sound measurements of axial and propeller fans. This realistic approach will help to prevent specifying low levels which are not attainable either in theory or in practice. It will also help to eliminate controversy arising from unsatisfactory installations where all of the facts were not understood.

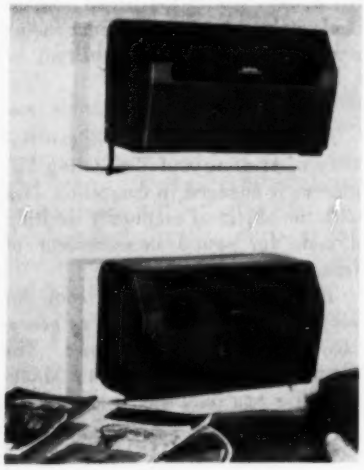
Conditioners Installed Within Building Line

AN INGENIOUS room air conditioner installation, in Havana, provides an answer to the problem of how to install a room air conditioner where rules forbid protrusions past the building line.

Two ¾ ton units were needed in an oculist's office containing only one outer wall. The air conditioners were placed one under the other in attractive wooden frames.

The 16¾ in. outer cabinet was brought within the building wall line by constructing 6 in. extensions, made of wood and painted to blend with the interior color scheme, to look like attractive picture frames.

The remaining portion of the outer cabinet is enclosed within the outer wall, with enough space left for a decorative wood or metal louvered grille, which can be added to "clean up" the outside appearance.



TO SOLVE THE problem of installing these room air conditioners where rules forbid their extending beyond the building line, the two ¾ ton units for an oculist's office were placed in specially built outer cabinets through the one outer wall

The following points must be considered in this type of installation, according to engineers of the Mitchell Mfg. Co.:

1) A space of 4 in. on each side of the outer cabinet is *minimum* to allow for the condenser air inlet to the outer cabinet side louvers.

2) The outer cabinet must be exactly level or pitched slightly down toward the outside to permit proper condensate removal.

3) The rain water drain should be carefully caulked at all joints so that heavy rainfall will not drain toward the room side.

4) The inside surfaces of the frames and insulation should be coated with spar varnish or other water-proofing finishes to prevent soaking or warping.

Roof Ventilator Solves Heat Exhaust Problem

Perhaps the most dramatic feature of the Ford Motor Co.'s remodeled rotunda building, Dearborn, Mich., is its dome. Covered with a clear plastic "skin", this dome presented a unique heat exhaust problem which was solved by installing a power roof ventilator in the top of the dome, according to the De Bothezat Fans Div., American Machine and Metals, Inc.

The ventilator was especially made of aluminum to save weight and to match the framework of the dome. It has a 36 in. fan wheel which exhausts 5000 cfm at low speed and 8000 cfm at high speed.

Air Conditioning Aids Metal, Coal Mining

FOUR MINES ON three continents have signed contracts for the installation of underground cooling systems to aid digging operations deep in the earth, it was reported recently by Carrier Corp.

They include two gold mines in South Africa, a coal mine in Belgium, and a copper mine in Australia.

The main problem in all but one of them is that rock temperatures climb as the mines go deeper underground, approaching temperatures of 130 F in some cases, making working conditions intolerable. The lone exception is the Australian mine where high surface air temperatures create the need for air conditioning.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL *SECTION*

Prediction of Cooling Tower Performance

By Wesley W. Smith*, College Station, Tex.

SUMMARY—A method is given to facilitate the approximate prediction of counterflow cooling tower performance under conditions of variable water rate, air rate, wet bulb temperature, cooling range, approach to wet bulb temperature, and elevation above sea level. The method has been developed in the course of work on a cooling tower research project being conducted by the Texas Engineering Experiment Station.

THE NEED for closer evaluation and prediction of mechanical draft cooling tower performance is becoming more noticeable as more and more installations are being put into operation. Some of these installations cost hundreds of thousands of dollars. While many manufacturers have the experience and knowledge needed to build equipment that meets specified requirements, the fact remains that there are many towers in operation today that have never been able to meet their performance specifications.

The many variables (some controlled, others uncontrollable in actual operation) make the determination of the performance, even at a given time, a difficult task. The prediction of operation under other than tested conditions becomes still more difficult, and might be practically impossible with any degree of assurance were it not for the evolution and development work by Robinson[1], McAdams[2], Merkel[3], Nottage[4], Lichenstein[5], and others whose academic considerations of a correlation method were used as the basis for the approximate method described in this paper.

Cooling Tower Approach Curves

Fortunately, the most important external factors bearing on the performance of a counterflow cooling tower have been grouped so that their effects are determined from solution of the equation:[6]

$$\frac{KaV}{L} = \int_{t_2}^{t_1} \frac{dt}{h'' - h_a} \qquad (1)$$

in which

K = water evaporated, pounds per (square foot of exposed surface) (hour) (unit vapor content differential).

a = exposed surface area, square feet per cubic foot of active tower volume.

V = active tower volume, cubic feet per square foot of tower ground area.

L = water flowing through the tower pounds per (hour) (square foot of ground area).

G = dry air flowing through the tower pounds per (hour) (square foot of tower ground area).

t_1 = temperature of the water entering the tower, Fahrenheit.

t_2 = temperature of the water off of tower, Fahrenheit.

t = temperature of the water in the tower, Fahrenheit.

h'' = enthalpy of saturated air at temperature t, Btu per pound of dry air.

h_a = enthalpy of air stream in tower at position where water temperature is t, Btu per pound of dry air.

Fig. 1, constructed from this equation, represents the currently usable values of KaV/L and L/G for sea level operation at a wet bulb temperature of 70 F and a range of 20 deg. The circled points were ob-

*Associate Research Engineer, Texas Engineering Experiment Station, Texas A. & M. College System.

[1]Exponent numerals refer to Bibliography.

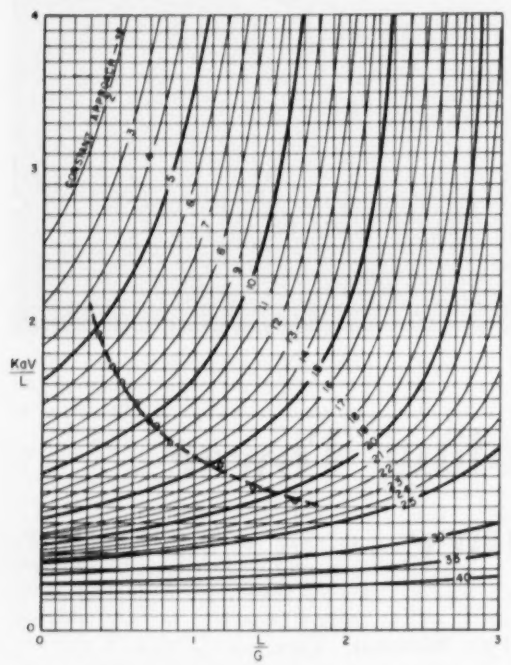


Fig. 1—Cooling tower approach curves (70 F wet bulb with 20 F range at sea level barometric pressure)

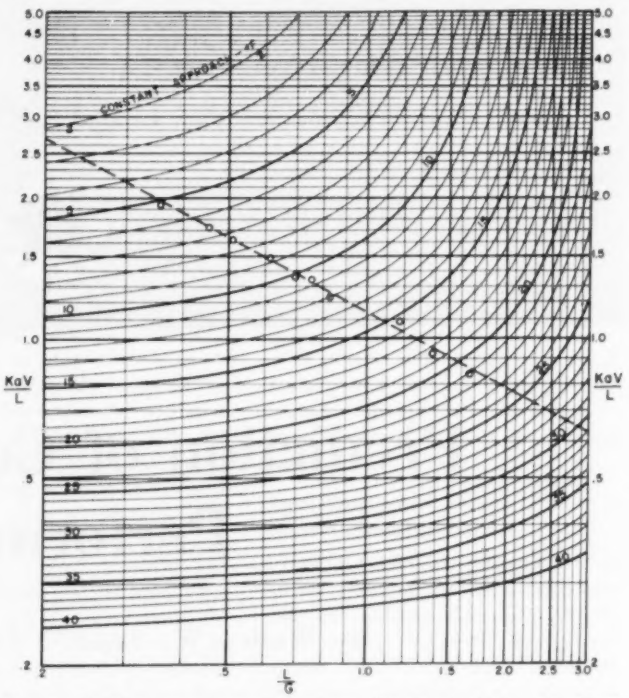


Fig. 2—Cooling tower approach curves (70 F wet bulb with 20 F range at sea level barometric pressure)

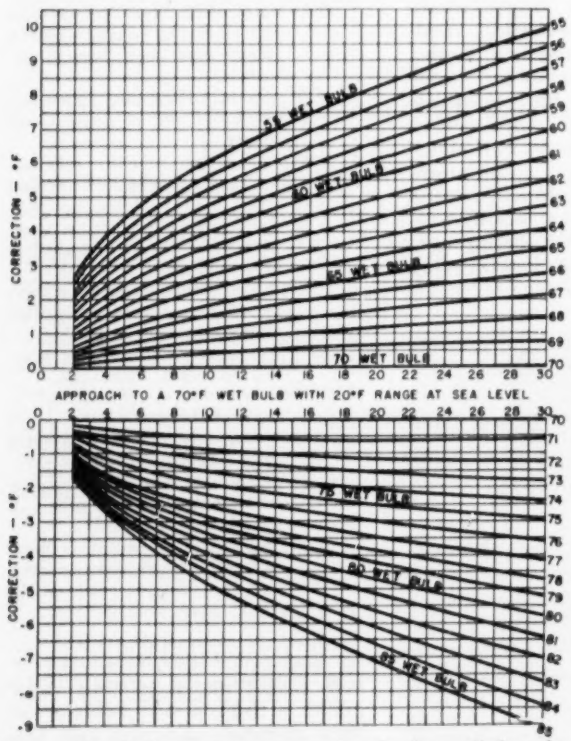

CORRECTION - °F
APPROACH TO A 70°F WET BULB WITH 20°F RANGE AT SEA LEVEL
55 WET BULB
60 WET BULB
65 WET BULB
70 WET BULB
75 WET BULB
80 WET BULB
85 WET BULB

Fig. 3—Wet bulb temperature correction (to be applied to the approach to a 70 F wet bulb with 20 F range at sea level barometric pressure)

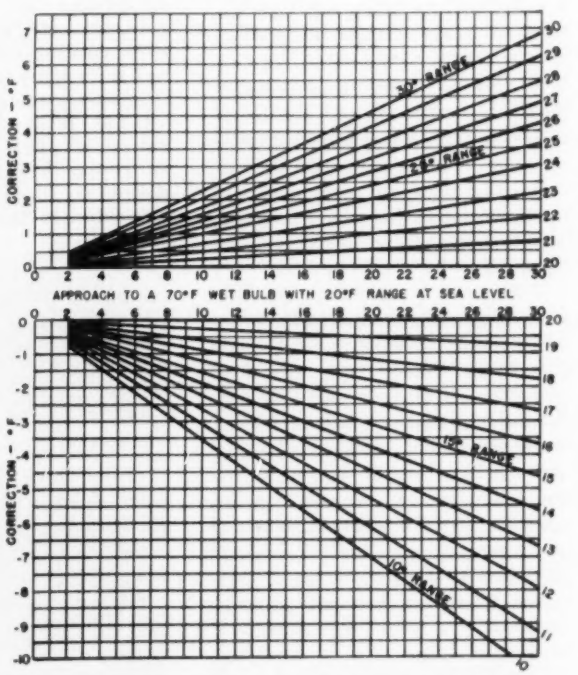


Fig. 4—Range correction (to be applied to the approach to a 70 F wet bulb with 20 F range at sea level barometric pressure)

tained from tests of an 8- by 8-ft experimental tower, while the dotted line represents the probable tower characteristic curve. Fig. 2 contains the same information as Fig. 1 plotted on logarithmic scales for KaV/L and L/G. The tower characteristic curve appears in Fig. 2 as a straight line whose equation can be written:

$$KaV/L = 1.14\ (L/G)^{-0.56} \quad \ldots\ldots(2)$$

from which

$$KaV = 1.14\ L^{0.44}\ G^{0.56} \quad \ldots\ldots(3)$$

As no pattern has yet been discovered to explain the value of the multiplier or the exponents, a tower curve must be established by actual test. Fortunately, the majority of actual towers appear to have characteristic curves that are very nearly straight on logarithmic paper and therefore two points will suffice to establish the line for a reasonably accurate performance criterion.

When a tower curve has been established, prediction of tower performance becomes a matter of superimposing this curve over the proper set of approach curves. Unfortunately approach curves are not at present available for all the conditions encountered, and probably will not be obtained except by some cooperative effort of those who require them. If curves were constructed for each 2-deg interval of range from 8 F to 50 F, and for wet bulb temperatures in 2-deg intervals from 32 F to 90 F, the result would be 660 drawings of approximately 40 curves each. If this construction were completed now for 1000-ft intervals of elevation up to and including 10,000 ft, the number of drawings would become 7260.

Figs. 2, 3, 4, and 5 are presented as an approximate solution to the problem covering 55 F to 85 F wet bulb temperature, 10- to 30-deg range, sea level to 8000-ft elevation, and L/G ratios between 0.5 and 2.0. All prediction calculations are based on sea level performance with 70 F wet bulb temperature and 20-deg range. Proper corrections for wet bulb temperature, range, and elevation are applied to the approach under these conditions to compensate for different wet bulb temperatures, ranges, and elevations. The following example will serve to clarify the method:

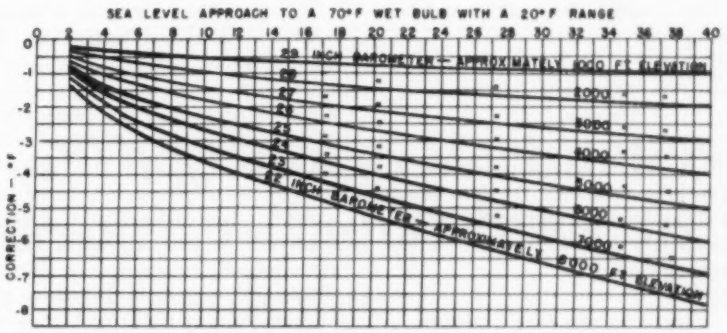

SEA LEVEL APPROACH TO A 70° F WET BULB WITH A 20° F RANGE
CORRECTION — °F
29 INCH BAROMETER — APPROXIMATELY 2000 FT ELEVATION
28 INCH BAROMETER — APPROXIMATELY 1000 FT ELEVATION
27 INCH BAROMETER — APPROXIMATELY 2000 FT ELEVATION
26 INCH BAROMETER — APPROXIMATELY 3000 FT ELEVATION
25 INCH BAROMETER — APPROXIMATELY 4000 FT ELEVATION
24 INCH BAROMETER — APPROXIMATELY 5000 FT ELEVATION
23 INCH BAROMETER — APPROXIMATELY 6000 FT ELEVATION
22 INCH BAROMETER — APPROXIMATELY 7000 FT ELEVATION
21 INCH BAROMETER — APPROXIMATELY 8000 FT ELEVATION

Fig. 5—Elevation correction (to be applied to the approach to a 70 F wet bulb with 20 F range at sea level to find the approach for other barometric pressures)

Example 1: The experimental tower with the characteristic curve of Fig. 2 is to operate at an L/G of 1.20 at 7000-ft elevation, with a wet bulb of 62 F, and with a 25-deg range. Determine the inlet and outlet water temperatures.

Solution:

Item 1. Approach obtained from Fig. 2 for L/G of 1.2 = 16.1

Item 2. Correction to approach of *Item 1* from Fig. 3 and 62 F = + 4.0

Item 3. *Item 1* plus (algebraically) *Item 2* = 20.1

Item 4. Correction to approach of *Item 1* from Fig. 4 and 25 deg = + 2.0

Item 5. *Item 3* plus (algebraically) *Item 4* = 22.1

Item 6. Correction to approach of *Item 1* from Fig. 5 and 7000 ft = − 4.1

Item 7. *Item 5* − *Item 6* = 18.0

Item 7 is the required approach = 18 deg.

The temperature of water leaving tower = sum of wet bulb temperature, 62 F, and 18 deg approach = 80 F.

The temperature of water entering tower = temperature of water leaving tower + range = 80 + 25 = 105 F.

Air Flow

All preceding calculations have been based on the assumption that the same L/G could be maintained even for significant changes in air density resulting from large changes of elevation. For the same water loading, L/G can be maintained constant at altitudes, but this necessitates a change in fan characteristics and an increase in horsepower. If the altered combination has the same efficiency as the sea level installation, then it can be shown that under certain idealized conditions for constant G:

$$P_x = P_o\ (\rho_o/\rho_x)^3 = P_o\ (V_x/V_o)^3 \ldots(4)$$

or for same temperature and relative humidity:

$$P_x = P_o\ (B_o/B_x)^3 \quad \ldots\ldots\ldots\ldots(5)$$

where

P_x = horsepower at altitude x.
P_o = horsepower at sea level.
ρ_o = air density at sea level.
ρ_x = air density at altitude x.
V_x = air specific volume at altitude x.
V_o = air specific volume at sea level.
B_o = barometric pressure at sea level.
B_x = barometric pressure at altitude x.

The horsepower for *Example 1* would be:

$$P_{30in} = P_o\ (30/23)^3 = 1.7\ P_o$$

This 70 percent increase in horsepower, in addition to being a considerable first cost item, would also mean a considerable increase in operating expense. Therefore, the advisability of using a smaller quantity of air, G, should be investigated.

The expected relation for horsepower as a function of G and ρ is:

$$P_x = P_o \left(\frac{G_x}{G_o}\right)^3 \left(\frac{\rho_o}{\rho_x}\right)^g \quad \ldots\ldots\ldots\ldots(6)$$

For constant temperature and humidity this would become:

$$P_x = P_o \left(\frac{G_x}{G_o}\right)^3 \left(\frac{B_o}{B_x}\right)^2 \quad \text{(7)}$$

If in *Example 1* the horsepower were kept constant, (the fan would, in all probability, require alteration), the air flow at 7000 ft altitude would become:

$$G_{7000} = G_o \ (23/30)^2/^3 = 0.84 G_o$$

With a constant water loading, this would result in a change from a value of L/G of 1.20 to a value of 1.43. The example tower would have an approach of 20.6 deg. It should be noted that this approach is better than the 22.1 deg approach of the same tower with the same horsepower operated at sea level.

The horsepower required to maintain the same volumetric rate of flow at 7000 ft, as at sea level, would be:

$$P_{7000} = P_o \ (\rho_x/\rho_o) = 0.77 \ P_o$$

The resulting G and L/G for constant water loading would be, respectively, $0.77G_o$ and 1.57. The 7000-ft tower would have an approach of 21.9 deg which is practically the same as the 22.1 deg of the sea level tower. Note that it is also probable that no change in fan characteristics would be necessary for this operating condition.

Conclusions

The tower evaluation method described involving the expression,

$$\frac{K\alpha V}{L} = \int_{t_2}^{t_1} \frac{dt}{h'' - h_a}$$

has been found to give reasonably good results although influenced by factors which at present either are not recognized or whose influences are not adequately evaluated. Construction and wide distribution of a complete set of graphs similar to Fig. 2 would naturally lead to better understanding of cooling tower phenomena; improve the customer-manufacturer relationship; and tend to minimize unethical practices.

The approximate method of tower evaluation described herein and involving the use of Figs. 2, 3, 4, and 5, although admittedly rough, nevertheless is probably much better than the methods usually used by the cooling tower operator. The altitude analysis is idealized but based on sound fundamentals and therefore is believed to be generally correct. Until experimental verifications of altitude effects are obtained, the foregoing can serve as a guide to cooling tower performance at elevations.

The improvement in tower performance with increase in altitude is considerable if the same weight of air is handled. However, as this involves a significant increase in fan horsepower for large altitude increases, a reduction in the value of G may be advisable with either a similar reduction in L to maintain a constant L/G or with an unchanged L resulting in an increase in L/G. *Example 1* discussed in this paper is interesting especially in illustrating that virtually the same performance was expected for a 7000-ft elevation as for sea level but with about one-quarter decrease in fan horsepower.

Acknowledgment

The author wishes to acknowledge the assistance of Lilie-Hoffmann Cooling Towers, Inc. in supplying equipment and also practical advice on cooling tower construction and operation.

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V.P. WRITES ON CONTROLS

John E. Haines, Minneapolis, Minn. is receiving congratulations for his contribution of an elementary text book on *Automatic Controls for Heating and Air Conditioning*. This new book dealing with all phases of automatic controls is a real contribution to the literature on heating and air conditioning. A detailed review of this new volume will be found on page 224 of this issue.

HOME AIR CONDITIONING, A BIG INDUSTRY OF THE '50's

"This year will likely go down in history as the year that brought climate-control to the American home. Just as central heating created a revolution in home comfort 75 years ago, so is air conditioning sweeping the country in a boom that promises to make it one of our biggest industries."

These observations appeared in a featured article, *Air-Conditioning for Every Home*, by Norman Carlisle in the August issue of *Coronet*.

"Millions spent on research since World War II," revealed Mr. Carlisle, "have paid off with a variety of devices that have jumped out of the laboratory stage into mass production with unexpected swiftness."

Mr. Carlisle estimates that last year Americans handed out more than $250,000,000 to have air conditioning in their homes, and that this year the industry expects to double its record production of close to 425,000 room units. Moreover, the industry can count on installing whole-house systems in at least 50,000 homes, of which 30,000 will be new ones.

"With all its benefits," concluded Mr. Carlisle, "there is no doubt that home air conditioning is becoming one of the big industries of the '50's. Even if it didn't make you healthier and give you a better home to live in, it would be bound to keep right on growing on the strength of its ability to provide just plain cool comfort."

Performance of Warm-Air Perimeter-Loop and Perimeter-Radial Systems in a Residence†

By H. T. Gilkey*, R. W. Roose**, and M. E. Childs‡,
Urbana, Ill.

SUMMARY—Performance data are given for two perimeter-loop and two perimeter-radial heating systems in Warm-Air Heating Research Residence No. 3 at the University of Illinois. This Residence was a low-cost basementless house with a concrete slab floor.

The perimeter-loop systems consisted of a 6-in. diameter warm-air duct embedded in the concrete slab in the form of a single loop around the periphery of the floor, and of five 6-in. diameter feeder ducts connecting the perimeter loop with a subfloor plenum below the furnace. The perimeter-radial systems consisted of six 6-in. diameter ducts which connected the registers directly to the subfloor plenum. Both deflecting and straight-vaned registers were used with each arrangement.

The room-air temperature differentials were smaller with the loop system than with the radial system. The use of deflecting registers caused smaller differentials than did the straight-vaned type. The floor-surface temperatures were higher and more uniform in pattern, and the heat emission from the warmed floor was greater with the loop system than with the radial system. The fuel consumption was less with the radial system than with the loop system.

THE USE OF the warm-air perimeter type of heating system in basementless houses, especially those with a concrete slab floor, has been accepted in many areas as being one practical answer toward heating these homes satisfactorily. One of the factors which has made this type of warm-air heating system acceptable is that warm floors are provided. Without some heat introduced into the floor of the concrete slab type of home, it has been proved that such difficulties as cold floor surfaces and condensation on these surfaces are likely to occur.[3] Although several variations of the warm-air perimeter system have been used, two of the most popular types are the perimeter-loop and perimeter-radial systems. In the warm-air perimeter-loop system, hereafter referred to as the loop system, the warm air from the furnace is delivered through subfloor feeder ducts to the perimeter duct which is embedded in the floor along the outer walls. The heated air flows through the perimeter duct and enters the rooms through registers usually placed underneath the windows or at other locations where the heat losses are high. In the perimeter-radial system, hereafter referred to as the radial system, the warm air from the furnace is delivered through subfloor feeder ducts directly to the registers and then into the room. In both systems heat is supplied to the rooms by convection from the registers and by a combination of radiation and natural convection from the heated floor surface.

The overall performances of two types of perimeter-loop systems were studied[2] previously in Warm-Air Heating Research Residence No. 3 during the 1949-50 and the 1950-51 heating seasons. In both of these seasons 8-in. diameter ducts were used for both the feeders and the perimeter loop. The performances of three convection systems were also studied in Research Residence No. 3 and compared[2] with the perimeter systems. In addition, laboratory studies of several factors affecting the design[3] of perimeter systems using 8-in. diameter ducts were conducted[4] in the Floor Slab Laboratory concurrently with the Residence No. 3 studies.

During the 1951-52 heating season further studies were conducted in

†This investigation is a part of the cooperative project jointly sponsored by the Engineering Experiment Station of the University of Illinois and the *National Warm Air Heating and Air Conditioning Association*. This paper reports one phase of an extensive study conducted in Warm-Air Heating Research Residence No. 3 during the period from 1949 to 1952.

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Presented at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Denver, Colo., June 29-30, July 1.

[1]Exponent numerals refer to References.

Fig. 1—Warm Air Heating Research Residence No. 3

Research Residence No. 3 in order to determine the performance characteristics of warm-air perimeter-loop and perimeter-radial heating systems in which 6-in. diameter ducts were used. Each system was studied with two different types of floor registers. One type of register was equipped with deflecting vanes in the register face; the other was not.

The overall objectives of this investigation were to determine for each system studied:

1. Uniformity of room-air temperatures at the sitting level throughout the house, and the response of the system to thermostatic control.
2. Room-air temperature differentials between the floor level and the sitting, breathing, and ceiling levels.
3. Magnitude and pattern of floor-surface temperatures.
4. Panel heating effect of the warmed floor surface.
5. General performance characteristics of the furnace.

Description and Procedure

Residence No. 3, shown in Fig. 1, was a single story, low-cost home with a concrete slab floor. The Residence, which was of standard construction, was provided with a relatively large amount of glass area. The walls were uninsulated, but the ceiling was insulated with mineral wool batts of 3⅝-in. thickness. With the exception of one picture window, double-hung wood-sash windows were used. The windows were neither weatherstripped nor equipped with storm sash. The outside doors were not weatherstripped, but storm doors were used. A floor plan of the Residence is shown in Fig. 2. The inside dimensions were 24 ft x 32 ft and the corresponding floor area was 768 sq ft. The design heat loss of the Residence for an outdoor temperature of −10 F and an indoor temperature of 70 F was 51,600 Btu per hr.

The floor-slab construction shown in Fig. 3 consisted of a 4-in. fill of coarse graded gravel placed on the original grade, a heavy duplex-paper vapor barrier (dampproofing membrane) and 4 in. of concrete. The insulation at the edge of the slab consisted of a 1-in. asphalt-sheathed glass fiber insulating board placed against the foundation wall and extending downward 12 in. from the top of the slab.

The loop system consisted of a 6-in. diameter warm-air duct embedded in the concrete slab in the form of a single loop around the periphery of the floor with a series of 6-in. diameter feeder ducts connecting the perimeter loop to a subfloor plenum below the furnace. A total of seven feeder ducts was installed, some of which were equipped with branches. Provisions were made for blocking the feeders at both ends and at the points where the branches joined the feeders so that any combination of the seven feeder ducts could be studied. The top of the feeder ducts was 6 in. below the floor surface

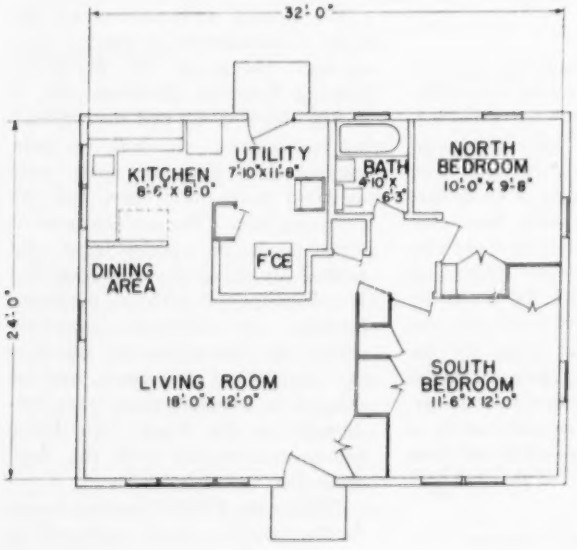


Fig. 2—Floor plan of Research Residence No. 3

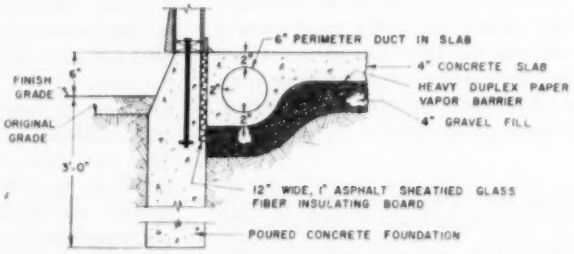


Fig. 3—Details of floor slab construction showing perimeter duct

at the plenum and sloped upward to the junction with the perimeter loop which was 2 in. below the floor.

The radial system consisted of six 6-in. diameter feeder ducts which connected the registers to the subfloor plenum. These feeders were the same as those previously discussed. When the radial system was in use, the perimeter loop was sealed on both sides of all registers and where it was joined by feeders not used with the radial system.

A gas-fired down-flow furnace having an input rating of 65,000 Btu per hr for natural gas was used. The warm air was delivered directly into the subfloor plenum below the furnace from which point it was forced outward through the feeder ducts to the perimeter loop and then through the registers. The air moved across the rooms to a single return-air intake in the living room and then into the furnace to be reheated. In the case of the radial system, the air was forced outward from the plenum, through the feeder ducts and then directly through the registers.

Two types of registers were used with both the loop and radial systems. One was a 4-in. x 14-in. floor register in which the axis of the shutter damper was parallel to the long axis of the register. The vanes in the face of the register were vertical and thus non-deflecting. The other type was a 2¼-in. x 14-in. floor register in which deflecting vanes were provided. The performance of the two types was compared with identical duct arrangements for both the loop and radial systems.

Five studies were conducted, three loop and two radial, designated as Series P-21, P-22, P-23, R-1, and R-2, respectively, and the duct arrangements are shown in Fig. 4. The four-feeder loop system (Series P-22) was not considered satisfactory because it was not possible to maintain the bedroom-air temperatures at the desired values, but the five-feeder loop systems (Series P-21 and P-23) were considered to be satisfactory as compared[2] with similar systems using 8-in. diameter ducts.

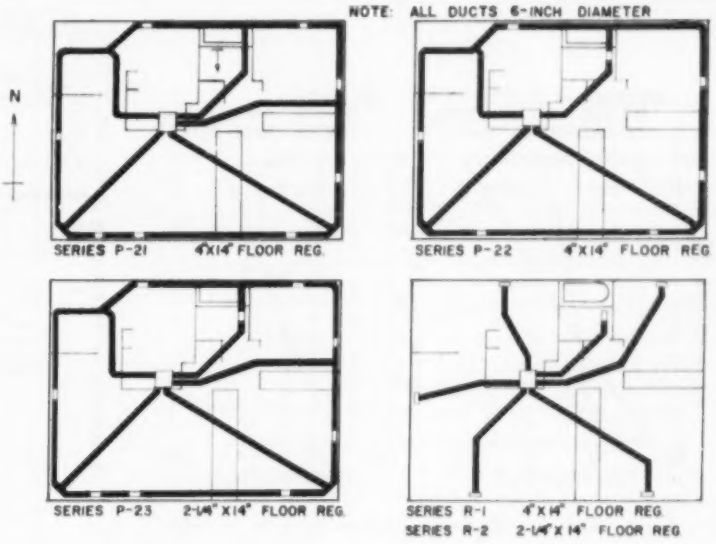

NOTE: ALL DUCTS 6-INCH DIAMETER
N
SERIES P-21 4"X14" FLOOR REG.
SERIES P-22 4"X14" FLOOR REG
SERIES P-23 2-1/4"X14" FLOOR REG
SERIES R-1 4"X14" FLOOR REG
SERIES R-2 2-1/4"X14" FLOOR REG

Fig. 4—Duct arrangements for perimeter-loop and perimeter-radial studies

The desired fuel-input rate of 65,000 Btu per hr was obtained by adjusting the burner manifold pressure at the pressure regulator at the furnace. This input rate of 65,000 Btu per hr was determined by dividing the design heat loss of the Residence (51,600 Btu per hr) by the assumed bonnet efficiency (0.80) of the furnace. The thermostat which was located at the 30-in. level in the living room was set at 72 F and this setting was not changed during the heating season. The differential setting of the thermostat was adjusted to the minimum point to provide frequent burner operations. The blower operated continuously, and its speed was adjusted[3] to provide an air temperature rise through the furnace of 100 deg under conditions of continuous burner and blower operation.

Complete instrumentation was provided for temperature measurement, including approximately 250 copper-constantan thermocouples. Instrumentation was also provided to measure the indoor relative humidity, electrical inputs to the gas valve and to the blower motor, the fuel-input rate, the flue gas composition, the hours of operation of the burner, and the air-flow rates in the duct systems.

Since it was not possible to evaluate all of the factors affecting comfort, emphasis was placed upon room-air temperatures and floor-surface temperatures. The study of air temperatures was devoted primarily to the conditions obtained in the living zone between the floor level and the breathing level, since temperatures above the breathing level are of little significance as far as comfort conditions in the home are concerned.

Uniformity of Room-Air Temperatures at Sitting Level

The cyclical variation of room-air temperatures was negligible with all five series, amounting to less than 0.5 deg. Also, the response of the system to sudden changes in outdoor temperature was considered to be satisfactory since no evidence of lag or overrun of room-air temperatures was experienced during periods of rapidly changing outdoor temperatures.

With the exception of Series P-22, the four-feeder loop system, little difficulty was encountered in balancing the systems. By adjusting the dampers in the floor registers, the air temperature in any room could

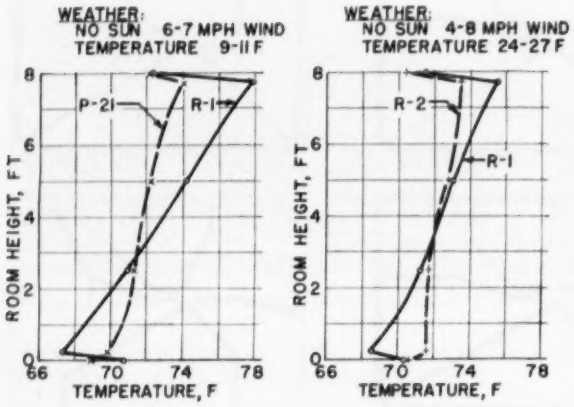
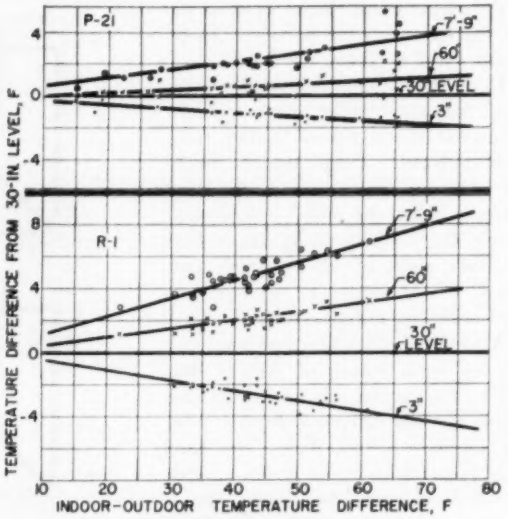


Fig. 5—Room-air temperature gradients in north bedroom



TEMPERATURE DIFFERENTIALS, F								
	INDOOR-OUTDOOR DIFFERENCE							
	35F				70F			
	P-21	P-23	R-1	R-2	P-21	P-23	R-1	R-2
3"FL - 30"FL	0.8	1.2	2.1	1.0	1.7	2.0	4.2	1.0
3"FL - 60"FL	1.4	1.4	3.7	2.6	3.0	2.4	7.8	2.3
3"FL - 3"CLG	2.8	2.3	5.9	3.2	5.5	3.3	12.0	3.3

Fig. 6—Room-air temperature differentials in north bedroom

be readily raised or lowered. The best balance was obtained with Series P-21 and P-23, the five-feeder loop systems. The temperature difference between the living room and the two bedrooms was consistently less than 1 deg, whereas with the two-radial systems the temperatures in the bedrooms were generally 1 to 2 deg lower than those in the living room.

The temperature difference between the warmest and coolest areas of the living room was less than 2 deg for all four series of studies. When the loop systems were in use and the feeder duct extended into the exposed corner of the living room, the air temperatures in the corner were slightly higher than when the radial systems were in use. They were also higher for a given duct arrangement when deflecting registers were used than they were with straight-vaned registers in use (Series P-23 *vs.* P-21 and R-2 *vs.* R-1). This confirms the desirability of extending the feeder ducts into the exposed corners as reported from the previous studies[2] and indicates the desirability of introducing the air into the room so that it is more evenly distributed along the exposed walls.

Room-Air Temperature Differentials

Satisfactory temperature differentials were obtained with both of the loop and both of the radial systems. The temperature gradients experienced in the north bedroom are shown in Fig. 5, and are representative of those experienced in the other rooms of the Residence. The comparison of Series P-21 and R-1 is shown for an outdoor temperature of about 10 F and a 6 to 7 mph wind. The more nearly vertical gradient experienced with Series P-21 has been attributed to the panel heating effect of the warmed floor. As will be discussed in the sections on Floor-Surface Temperatures and Heat Emission from the Floor, the warmer floors experienced with the loop system caused a greater panel heating effect and a consequent reduction in the amount of heat admitted into the rooms through the registers. For the same air-flow rate, the register-air temperatures were lower for the loop system, and as a result the air temperatures at the ceiling and breathing levels were also lower. In Fig. 5 it should be noted that the floor-surface temperature was higher for the radial system than for the loop system due to the proximity of the feeder to the floor-surface thermocouple. Since these temperatures were measured at the same locations for all series, changing to the feeder-duct for the radial system affected the floor-surface temperature, but not the air temperatures.

The effect of the deflecting type of floor register is shown in the comparison of the gradients for Series R-1 (non-deflecting) and R-2 (deflecting). This comparison was made at an outdoor temperature of approximately 25 F and a 4 to 8 mph wind. The deflecting vanes in the register face caused better mixing of the air leaving the register with the air in the room which in turn improved the room-air temperature gradients. When the deflecting register was used with the loop system (Series P-23), its effect was similar though not so pronounced as when it was used with the radial system.

The effect of outdoor temperature on the room-air temperature differ-

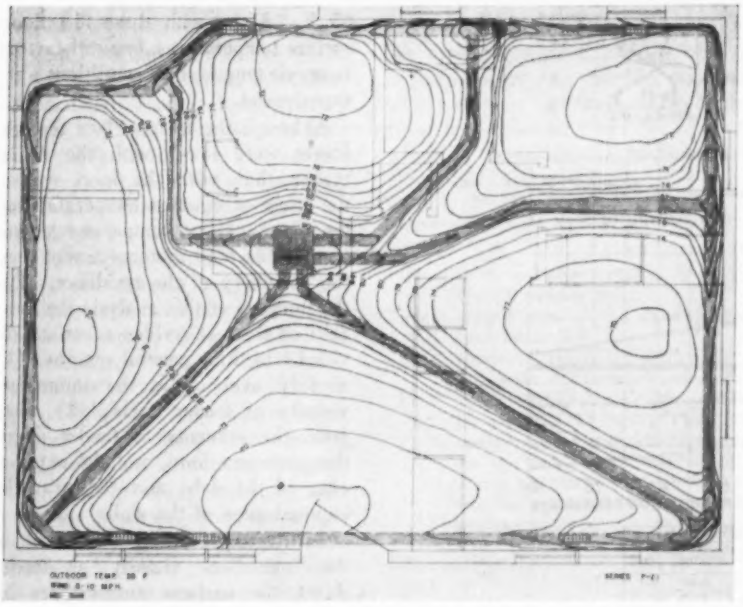


Fig. 7—Floor-surface isotherms with perimeter-loop system (Series P-21)

entials in the north bedroom is shown in Fig. 6 for Series P-21 and R-1. These differentials are typical of those experienced in other rooms of the Residence. The heated floor panel produced by the loop system decreased the effect of outdoor temperature on the differentials from that experienced with the radial system. The differentials for indoor-outdoor temperature differences of 35 and 70 deg are tabulated in Fig. 6 for all four series. It can be seen that the floor to ceiling differentials were more satisfactory when the deflecting register was used. The effect of the deflecting type register was much more pronounced when used with the radial system than when used with the loop system.

The same bathroom register location was not used for all series. For Series P-21, air from the perimeter loop was admitted underneath the bath tub. The air then moved into the room through a long narrow grille located at the base of the tub. For Series P-23, a 2¼-in. x 14-in. deflecting floor register was placed directly over the feeder duct as shown in Fig. 4. At an outdoor temperature of 35 F, the floor to breathing level differential was 1.5 deg for Series P-21 and 4.2 deg for Series P-23. The floor to breathing level differentials in the bathroom were 4.4 deg for Series R-1 and 3.6 deg for Series R-2. This would seem to indicate that it is not advisable to place a register so that it delivers air directly from a feeder duct in a perimeter-loop system.

Floor-Surface Temperatures

The patterns of floor-surface temperatures obtained with the loop system (Series P-21) were more satisfactory than those obtained with the radial system (Series R-1). Typical floor-surface isotherms for Series P-21 are shown in Fig. 7. These isotherms show the conditions at the end of a three day period during which the outdoor temperature was between 30 and 35 F and the sky was overcast. Fig. 8 shows similar isotherms for Series R-1.

When the loop system was in use, the temperatures of only small areas of the floor surface were less than 70 F. The largest of these areas was in the living room near the front door where the floor-surface temperature was less than 68 F near the edge of the slab. Another low temperature area was in the kitchen where the perimeter loop did not extend under the built-in cabinets. The other areas with floor-surface temperatures below 70 F were in the west portion of the living room and in the south bedroom. A limited area having floor-surface temper-

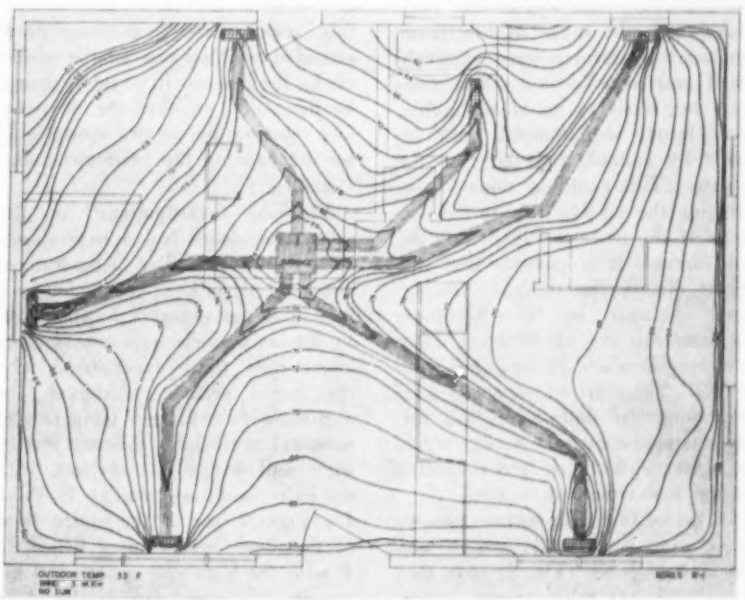
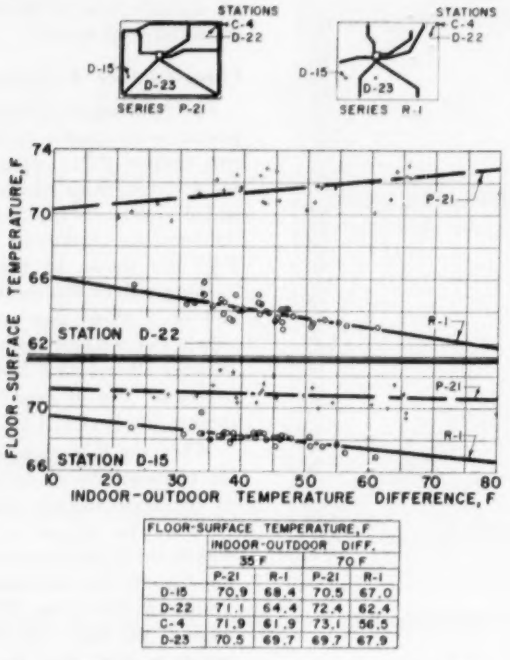


Fig. 8—Floor-surface isotherms with perimeter-radial system (Series R-1)



FLOOR-SURFACE TEMPERATURE, F				
	INDOOR-OUTDOOR DIFF.			
	35 F		70 F	
	P-21	R-1	P-21	R-1
D-15	70.9	68.4	70.5	67.0
D-22	71.1	64.4	72.4	62.4
C-4	71.9	61.9	73.1	56.5
D-23	70.5	69.7	69.7	67.9

Fig. 9—Effect of outdoor temperature on selected floor-surface temperatures

atures in excess of 90 F existed in the immediate vicinity of the furnace and subfloor plenum. However, this was not considered to be objectionable since the areas were small and were not used as living areas.

Although the areas of low floor-surface temperatures were relatively small and were located where they were not likely to be objectionable, some minor improvement could be made by suitable balancing of the system. This could be done by increasing the air-flow rate in the sections of the perimeter loop near the cold areas. It is possible that this might disturb the room-air temperature balance in the Residence by lowering the air delivery from some registers and increasing it from others. The most effective means of improving the pattern of floor-surface temperatures, however, would be to locate additional feeders leading to the low temperature areas.

Areas of low floor-surface temperature were considerably greater with the radial system (Fig. 8) than they were with the loop system. Near the exposed edge of the slab, the floor-surface temperature was greater than 70 F only in the immediate vicinity of the feeder ducts. Between feeders the floor-surface temperature was below 60 F at the edge of the slab, and areas having surface temperatures less than 70 F extended well in toward the center of the Residence. It would of course be impossible to alter the floor-surface temperature pattern appreciably by re-balancing the perimeter-radial system.

Previous investigations[2] in Research Residence No. 3 have shown that the floor-surface temperatures experienced with a convection system with the registers located high on the inside walls were considerably lower than those experienced with the radial system. Although the minimum floor-surface temperatures were not appreciably different for the high wall and radial systems, with outdoor conditions similar to those for Figs. 7 and 8 the entire floor surface had temperatures below 70 F with the high-wall system and approximately one-half of the floor surface had temperatures less than 65 F. Along with these low floor-surface temperatures, less satisfactory room-air temperature conditions were experienced.

Although the floor-surface temperatures were lower with the radial system than with the loop system, the effect of outdoor temperature on the floor-surface temperatures was similar for both systems except near the periphery of the residence. For the purpose of this analysis the floor area of the test residence can be divided into three general regions: (1) directly over or in the immediate vicinity of feeder ducts; (2) away from the influence of feeder ducts, the perimeter loop, and the exposed edge of the slab; and (3) near the exposed edge of the slab.

In Region 1 directly over or in the immediate vicinity of feeder ducts, the surface temperatures increased as the outdoor temperature decreased. This was true for both the loop and the radial systems and was caused by the higher duct-air temperatures necessary to compensate for the increased heat loss of the Residence.

In Region 2 away from the influences of feeder ducts, the perimeter loop, and the exposed edge of the slab, the floor-surface temperature decreased with decreasing outdoor temperature. This is shown for Series P-21 and R-1 by the curves labelled D-15 in Fig. 9. Although the presence of the perimeter loop in Series P-21 undoubtedly caused the surface temperature to be higher at this point than it was when the loop was not in use (Series R-1), the slopes of the curves are typical of those encountered for Region 2. It can be seen that the outdoor temperature had an only slightly greater effect on the floor-surface temperature with the radial system than with the loop system since the slope of the curve is slightly greater for Series R-1 than for Series P-21. This is in agreement with the results[2] found in Residence No. 3 during the 1949-50 heating season when the high-sidewall and low-sidewall convection systems were in use.

In Region 3, near the exposed edge of the slab the outdoor temperature

effect on the loop system was quite different from the effect on the radial system. This comparison for Series P-21 and R-1 is shown by the curves labelled D-22 in Fig. 9. At this point, approximately 1.5 ft from the north and east walls of the Residence, the floor-surface temperature increased as the outdoor temperature decreased when the perimeter loop was in use (Series P-21). It decreased sharply with decreasing outdoor temperature, however, when the perimeter loop was not in use (Series R-1). The curve for Series P-21 is representative of the temperatures observed on the floor surface in the vicinity of those sections of the perimeter loop in which there was sufficient air flowing. Near those sections of the perimeter loop in which there was little air motion, such as along the south exposure near the front door, the floor-surface temperatures for Series P-21 were similar to those away from both feeder and perimeter ducts *i.e.*, higher and with less effect from the outdoor temperature than for Series R-1. The curve for Series R-1 is representative of the temperatures observed on the floor surface near the exposed edge of the slab for the radial system.

Heat Emission from the Floor

Although both the loop and radial systems are primarily convection heating systems, there is an appreciable panel-heating effect from the warm floor. This is particularly true of the loop system in which most of the floor surface is at a temperature greater than that of the air in the rooms. This heat emission from the floor can be considered as having two components: radiation heat transfer from the floor surface to the walls and ceiling, and heat transferred by natural convection from the floor surface to the air adjacent to it. The methods used to calculate the total heat emission are the same as used by Sjordal[6] and Sadler[7] in the special studies that have been conducted and reported[2] for Residence No. 3.

The radiation heat transfer depends upon the area and temperature of the emitting surface, the temperature of the receiving surface, and the configuration factor between the emitting and receiving surfaces. The equation recommended by McAdams,[8] which is based on the Stefan-Boltzmann law, was used:

$$Q_r = 0.173 \times 10^{8} A_S F_A (T_S^4 - T_R^4) \quad (1)$$

where

Q_r = radiation heat transfer, Btu per (hour) (square foot).
A_S = surface area of the emitting surface, square feet.
T_S = absolute temperature of the emitting surface, Fahrenheit, absolute.
T_R = absolute temperature of the receiving surface, Fahrenheit, absolute.
F_A = configuration factor which considers the solid angle between the source and the receiver, the areas, and the emissivities of the source and the receiver.

The configuration factor can be evaluated by:

$$F_A = \frac{1}{\frac{1}{F_b} + \left[\frac{1}{e_S} - 1\right] + \frac{A_S}{A_R}\left[\frac{1}{e_R} - 1\right]} \quad (2)$$

where

F_b = configuration factor for black body radiation.
e_S = emissivity of the emitting surface.
e_R = emissivity of the receiving surface.
A_S = area of the emitting surface, square feet.
A_R = area of the receiving surface, square feet.

Since the emitting surface, the floor, was enclosed on all sides by the receiving surfaces, the walls and ceiling, both F_b and A_S/A_R can be considered as equal to 1. The emissivities of both the floors and the walls and ceiling were assumed to be 0.90. The value of the configuration factor F_A was then

$$F_A = \frac{1}{1 + \left[\frac{1}{0.9} - 1\right] + 1\left[\frac{1}{0.9} - 1\right]} = 0.82$$

The area of the emitting surface was measured for each 2 deg increment of floor-surface temperature T_S. For instance, for Series P-21, the area between two adjacent isotherms was measured from Fig. 7, and the temperature was taken as the average of those represented by the isothermal lines. Thus, the area between the 80 F and 82 F isotherm was found to be 24.12 sq ft and this was assumed to be at a temperature of 81 F or 541 R (F absolute).

The temperature of the receiving surface, T_R, was the weighted average temperature of the walls, ceiling, and windows of the Residence and was evaluated by the average surface temperature method. Thus, the average surface temperature for any room, T_R, was the sum of the products of the wall, ceiling, and window areas and temperatures divided by the total area of walls, ceiling, and windows of the room. This may be expressed as:

$$T_R = \frac{(A_N T_N + A_S T_S + A_E T_E + A_W T_W + A_C T_C + A_G T_G)}{(A_N + A_S + A_E + A_W + A_C + A_G)} \quad (3)$$

Table 1—Heat Emitted from Floor and Through Registers for Perimeter-Loop and Perimeter-Radial Heating Systems

Room	Perimeter-Loop System: Heat Emission from Floor, Btu/hr: Radiation	Convection	Total	Heat from Reg. Btu/hr	Total to Room, Btu/hr	Perimeter-Radial System: Heat Emission from Floor, Btu/hr: Radiation	Convection	Total	Heat From Reg. Btu/hr	Total to Room, Btu/hr
Liv Rm	1,260	630	1,890	1,940	3,830	440	440	880	5,020	5,900
S Bed Rm	650	300	950	1,590	2,540	−70	70	0	1,770	1,770
N Bed Rm	420	230	650	1,800	2,450	−10	80	70	1,830	1,900
Hall	190	210	400	—	400	110	170	280	—	280
Bathroom	120	100	220	320	540	−20	30	10	1,260	1,270
Kitchen-Utility	680	470	1,150	1,080	2,230	320	390	710	2,240	2,950
Total	3,320	1,940	5,260	6,730	11,990	770	1,180	1,950	10,120	12,070

Weather: Series P-21: Outdoor Temp 35 F; Wind 7.5 mph (SSE); Sky Overcast.
Series R-1: Outdoor Temp 36 F; Wind 3 mph (SSE); Sky Overcast.

The subscripts N, S, E, and W refer to north, south, east and west walls, C refers to ceiling, and G refers to windows. Although this average surface temperature method lacks the precision of the mean radiant temperature method, the computation of configuration factors for use with the latter method would be extremely complex and tedious due to the large window areas and to the wide range and non-uniform pattern of floor-surface temperatures. Furthermore, Jamieson,[4] has shown that little error is introduced by the use of the less precise average surface temperature method.

The natural convection heat transfer from the floor surface to the air adjacent to it was calculated using King's[9] equation which was found by Jamieson to give good results. For sections of the floor warmer than the adjacent air, the convection component of the total heat emission from the floor surface becomes:

$$Q_c = 0.28\ A_s\Theta^{1.25} \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

where

Q_c = heat transfer by natural convection, Btu per (hour) (square foot).

Θ = temperature difference between the surface and the air, Fahrenheit degrees.

For sections of the floor colder than the adjacent air

$$Q_c = 0.15\ A_s\Theta^{1.25} \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

In both cases A_s was evaluated in the same manner as for the radiation component, and θ was evaluated from t_s, the average floor-surface temperature of A_s, and the average air temperature 3 in. above the floor. In the case of the loop system, Series P-21, this average air temperature was 70 F; for the radial system, Series R-1, it was 68 F.

Table 1 shows the total heat supplied to each room of the residence for Series P-21 and R-1. For the loop system the heat emitted from the floor, 5,260 Btu per hr, was 44 percent of the total energy, 11,990 Btu per hr, which entered the rooms from the air heated in the furnace. In the case of the radial system, the heat emitted from the floor, 1,950 Btu per hr, was 16 percent of the total energy, 12,070 Btu per hr, which entered the rooms. For a three-feeder loop system using 8-in. diameter ducts this value was found[2] to be 3,100 Btu per hr, or 25 percent of the total when the outdoor conditions were essentially the same as for Series P-21 and R-1.

Table 2—Summary of Performance Data for Burner and Blower for Series P-21 at an Outdoor Temperature of 35 F

a. Blower Operation, hr per day	24
b. Electrical Input to Blower Motor, Watt-hr per day	3,100
c. Average Bonnet-Air Temperature, F	110
d. Burner Operations, hr per day	8
e. Burner Operations, per 24 hr	167
f. Average Flue-Gas Temperature, F	220
g. Fuel Consumption, cu ft per day	470

Although a complete energy balance study was not made for either Series P-21 or R-1, the excellent agreement between the total heat supplied to the rooms for the two systems indicates that the results are reasonable. Sources of energy which were not considered in these studies were heat gains from the furnace casing and flue pipe, energy from observers, and miscellaneous electrical inputs such as lights, controls, etc.

Table 3—Comparison of Fuel Consumptions of Perimeter-Loop and Perimeter-Radial Systems

Series	Fuel Consumption Cu ft per day	
Outdoor Temp.,	35	0
P-21	470	940
P-23	460	910
R-1	400	750
R-2	390	780

Performance of Furnace

Complete performance data for the furnace were obtained over a wide range of indoor-outdoor temperature differences. The general performance characteristics were essentially the same for all four series since the operating conditions were identical. These conditions were in accordance with the continuous air circulation principle,[5] with the one exception mentioned previously. The differential setting of the room thermostat was adjusted to provide short cycling of the burner during mild weather, the fuel-input rate was adjusted to equal the heat loss of the house divided by the assumed bonnet efficiency, and the blower was adjusted to provide a temperature rise through the furnace of 100 deg. A summary of the performance data for Series P-21 for an outdoor temperature of 35 F is shown in Table 2.

Comparisons of the fuel consumptions of the four systems are given in Table 3. The fuel consumption was about 16 percent less for the radial system than for the loop system. This was attributed primarily to the larger subfloor and edge losses which were experienced when the perimeter loop was in use. It should be noted, however, that the fuel consumption of the loop system was less than that which was experienced with a convection system[2] using high-sidewall delivery.

Table 4—Pressure Losses for Perimeter-Loop and Perimeter-Radial Systems

Series	Pressure Loss, in. of water			Air-Flow Rate, cfm
	Warm-Air	Return-Air	Total	
P-21	0.08	0.05	0.13	430
P-23	0.11	0.05	0.16	440
R-1	0.12	0.05	0.17	450
R-2	0.16	0.04	0.20	435

Pressure Losses for the Duct Systems

In connection with the blower performance, measurements were made of the pressure losses for the duct systems for Series P-21, P-23, R-1, and R-2. These measurements, which are shown in Table 4, were made on mild days when the furnace had been off for some time and the air temperature in the subfloor plenum was approximately 80 F. During periods of furnace operation, the pressure loss of the warm-air duct system remained constant and the pressure loss of the return-air system decreased. This occurred because the blower was located below the heat exchanger, and since the blower delivered an essentially constant volume of air, the air-flow rate in the warm-air ducts remained constant as the air temperature in the subfloor plenum increased. In the return-air duct, however, the air-flow rate decreased and the return-air temperature remained constant as the air temperature in the subfloor plenum increased.

For Series P-21, the five feeder loop system, the pressure loss was 0.08 in. of water for an air-flow rate of 430 cfm. With the same duct system but with the deflecting type of register in use, Series P-23, the pres-

sure loss was 0.11 in. of water. This increase was attributed solely to the use of the smaller deflecting register which imposed a greater resistance to air flow upon the blower. A similar difference was experienced with the radial systems, Series R-1 and R-2.

The pressure loss on the warm-air side of the system was found to be greater with the radial systems than with the loop systems. This difference was attributed to several factors. Although six feeder ducts were used with the radial system, one more than with the loop system, the feeder to the bathroom carried very little air. In addition the feeders for the radial system had more turns and were longer in some cases than those used with the loop system. Furthermore, fewer registers were used thus increasing the resistance in each register. It should be noted, however, that only in the case of Series R-2 did the pressure loss for the entire system equal 0.20 in. of water, the value usually used for designing warm-air heating systems.

Conclusions

The warm-air perimeter heating systems discussed in this paper were of two types. One was a five-feeder perimeter-loop system; the other was a six-feeder perimeter-radial system. The studies involved the use of conventional floor registers with straight vanes in the face and floor registers with deflecting vanes in the face with both duct systems. The ducts were of 6-in. diameter and were embedded in the concrete floor of the Residence. The same down-flow furnace was used with each system, and the warm air was forced directly from the furnace into the subfloor plenum and thence into the feeder ducts. In the case of the radial systems, the feeder ducts carried the air directly to the floor registers. In the case of the loop systems, the air flowed through the feeder ducts to the perimeter loop and through it to the registers. After entering the rooms through the registers, the air moved to a single return-air intake in the living room and then into the furnace to be reheated.

The response of the system to sudden changes in outdoor temperatures was considered to be satisfactory since no evidence of lag or overrun of room-air temperatures was experienced during periods of rapidly changing outdoor temperatures. The conventional room thermostat used with the systems proved to be satisfactory for controlling the room-air temperature. The practice of balancing the system by means of adjusting the shutter dampers on the floor registers proved to be satisfactory for both the loop and the radial systems.

Room-air temperature differentials were small. For example, at an outdoor temperature of 20 F, the temperature differential from the floor level to the breathing level was 2.1 deg for the loop system and 5.5 deg for the radial system. When the deflecting registers were used, these differentials were 1.8 and 2.9 deg for the loop and radial systems, respectively.

The floor-surface temperature patterns experienced with the radial system were not as satisfactory as those experienced with the loop system. With the loop system only three small areas were observed in which the floor-surface temperatures were less than 70 F when the outdoor temperature was 35 F. Large areas of the floor with temperatures less than 70 F were observed with the radial system under similar weather conditions, and near the exposed edge of the slab the floor-surface temperatures were less than 65 F.

The heat emitted from the floor surface for the loop system was 44 percent of the total heat which entered the room from the air heated in the furnace. For the radial system, 16 percent of the total heat which entered the rooms was emitted from the floor surface. Both of these values were calculated for an outdoor temperature of 35 F.

The fuel consumption with the radial system was about 16 percent less than with the loop system, and both were less than that previously experienced with a high-sidewall convection system. The pressure loss of the duct system was less with the loop system than with the radial system. The use of the small deflecting floor registers increased the pressure loss slightly, but it did not exceed 0.20 in. of water with any of the duct systems studied.

This is a report of studies conducted with the duct systems shown in Fig. 4. The radial systems were not designed in accordance with the recommendations[10] contained in the latest edition of *Manual 4* of the *National Warm Air Heating and Air Conditioning Association*. Had additional feeders and registers been incorporated into these systems, the room-air temperature balance and the floor-surface temperature patterns would have been improved. In addition, the pressure losses in the duct systems would have been smaller.

Acknowledgments

This paper reports one phase of a comprehensive investigation conducted in Warm-Air Heating Research Residence No. 3 under the terms of a cooperative agreement between the *National Warm Air Heating and Air Conditioning Association* and the Engineering Experiment Station of the University of Illinois. These results will ultimately comprise part of a bulletin of the Engineering Experiment Station. Acknowledgment is hereby made to the manufacturers who cooperated by furnishing materials and equipment used in this investigation.

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Discussion

W. M. MYLER, JR., Columbus, Ohio., (WRITTEN): This paper is a report on a new phase in the series of tests which have been run to determine the fundamentals involved in heating satisfactorily a typical one-story house built on a concrete slab floor.

Previously we have been given data on a gravity system, on forced air systems having both high and low wall types of registers, and on perimeter-loop systems made with 8-in. ducts. This paper carries us one step farther in showing results for a 6-in. duct perimeter-loop system with radial feeders and for a radial-perimeter system without loops, the registers being installed directly at the end of the radial feeders.

A study of the data contained in this paper and those previously published on this subject permits evaluation of the heating results obtainable, the cost of installation, and the relative operating costs for a number of possible types of warm air systems which could be applied to this concrete floor slab home.

Gravity systems and forced air systems using either high wall or low wall registers failed to produce satisfactory floor slab temperatures even when the slab was properly insulated at the edges.

Either 8-in. or 6-in. pipe can be used to make a highly satisfactory perimeter-loop radial-feeder system, but the operating cost is appreciably greater than that of a simple radial-perimeter system with registers installed directly at the end of the radials. The latter system would appear to be both cheaper to install and operate than the former and yet its performance is superior to a gravity or a conventional forced air system in this type of home.

While no series of tests can ever be said to be complete, at least this one has progressed to the point where the pitfalls of certain systems have become obvious. When these are avoided there will remain a reasonable number of types of systems of different first cost and operating cost to meet individual preferences and still give generally satisfactory performance.

C. M. TOELAER, Bloomfield (WRITTEN): This paper is a rather thorough study of a perimeter-loop system but I feel that the radial system has been presented in a very unfavorable way. As pointed out in the last paragraph of the paper, the tests on the radial system were not made on a properly installed system.

I believe the authors will agree that the degree of comfort and the stratification in the space are a function of the number of outlets installed, not of the number of buried feeder ducts, and also that the floor surface temperature and the uniformity of surface temperature are functions of the number of feeders.

A combination of minimum stratification and warm floors is desirable. If tests were conducted on a radial system with the same number of outlets as were used in the loop system, stratification would be a function of register design and leaving air velocity, and would be equal to, or better than, the loop system which does not offer quite as positive and effective a means of balancing. The floor surface temperatures would thus be more uniform than with the loop system because the number of radials would be increased.

The isotherm lines in Fig. 7 indicate clearly that there is virtually no air movement in the perimeter duct at the front of the house between the floor registers. This was shown much better and for all sides of the house in the previous paper by the authors. A system with three or four feeders is rather common practice in the industry.

If the loop duct is carrying little or no air, isotherm lines should be virtually unchanged if it were omitted. Basically, then, a perimeter-loop system is a radial system with two registers connected by branch ducts to the single feeder.

The flow of steam from two boilers into a bullhead tee may cause a bouncing water line. Similarly, a bullhead tee smoke pipe connection on two oil-fired furnaces or boilers may cause flame pulsation. Since air is also a gas, why should we expect good air distribution control when air is brought into a duct from two directions?

In homes for the modest-income-group, floor space is at a premium. Every square foot should be made available to the home owner. In small campact homes, floor space costs a home owner about $12.00 per sq ft. He cannot afford the loss of 6 to 8 sq ft of usable space for each outlet due to the inadvisability of placing furniture near floor registers. This amounts to over $800.00 in loss of floor space in each house so equipped. The register design is of utmost importance in basementless homes to prevent window down drafts and floor drafts, but consideration must also be given to freedom of furniture placement and use of maximum space.

I think the tests have been excellent and should be continued. The industry needs more such comprehensive studies. Unfortunately, the tests compare one of the best methods of doing the job with the loop system, with a radial system which is not up to the recommended standards. The best of both or trade practice in both should be the basis of the comparison. It might be well to conduct tests on a radial system as currently recommended by the *National Warm Air Heating and Air Conditioning Association* with a loop system feeding the four corners.

I would like to close by emphasizing that even though the radial system design was slightly contrary to current recommendations, it showed 16 percent lower operating cost than the loop system. Despite fewer outlets the radial system according to Fig. 6 had a room temperature gradient, under the most severe weather conditions, equal to, or better than, the loop system. It might have been much better had a more favorable radial system design been tested.

R. K. THULMAN, Washington, D.C., observed that the calculated heat loss for the residence was 51,000 Btu, or 67 Btu per sq ft, and consequently exceeded the maximum heat loss allowable by *Federal Housing Administration* requirements. The walls were not insulated and the windows were not weather-stripped. He inquired why a better construction had not been used. He also asked whether the difference between the loop system and the radial system might not have been less if insulation had been used in the residence and the construction had been improved.

R. S. DILL, Washington, D.C.: This paper is another example of the thorough kind of work that comes from the University of Illinois. If it has a fault, it doesn't describe in enough detail what the weather was like during these tests, because the hygrometric state of the earth under these heating ducts has a lot to do with the performance of the system. If there is rain or snow causing puddles next to the outside wall of the house, there is going to be a hydrostatic head tending to force water into the ducts. It is unreasonable to expect either a concrete wall or a floor or one of these so-called vapor barriers to be water-tight, so it is presumable that under such conditions, water will enter the duct. In winter when the heat is on, some water in the ducts will come out as vapor and make the humidity in the house excessive. I have seen puddles in ducts under houses, and it is obvious that the water will cause excessive humidity in the house.

The floor plan indicated the bottom of the ducts to be two or three inches below the outside grade. If it were my house, I would insist that the duct be above the outside grade. The tests described in the paper demonstrate that you can heat a house — and heat it satisfactorily — with either of these systems under good conditions. As far as we know there was neither rain nor snow during these tests. The laboratory equipment presumably was all in very good order for determining accurate results for the test conditions. I believe, however, some experiments are in order when the conditions are bad, when rain and snow and slush are on the ground outside and when there are defects in the workmanship.

There are other indications that this is a type of heating system that requires thorough supervision on the job. I know of a case in which some clay tile pipe was used for ducts, and consequently, the warm air escaped through the foundation wall of the building. That also obviously is not good.

This paper indicates that a house can be heated satisfactorily by a perimeter-loop or perimeter-radial system under good conditions. It seems advisable to demonstrate also that these systems can operate satisfactorily when conditions are bad due to excessive moisture in the soil caused by rain and snow, and due to defects in workmanship.

D. L. OSLUND, Minneapolis, Minn.: We, in the City of Minneapolis, have had considerable experience with perimeter heating in the last 14 months. Much pressure has been applied to the Department of Buildings to allow the use of slab-perimeter heating. Several installations were made within the city. At first, everything worked well until some contractors began to cut down on supervision, allowing the general contractor and cement men to install the insulation along the perimeter of the slab. This condition became unsatisfactory to the Department of Buildings and as a result we refused to allow any future installations of perimeter heating within the City of Minneapolis.

We understand that the thought behind the designer of perimeter heating was to reduce the cost of homes in the lower priced field. It is somewhat of a mystery to us, why the heating system should be singled out to cut building costs when such system is about 10 percent of the construction costs. There is no more important part of any home than its heating system, especially in Minneapolis.

The use of floor registers seems to us to be a step into the past. These floor registers not only prevent placement of furniture and require cutting holes in carpets, but become dust collectors when not in use. When in use, they continually fill the air stream with dust which is spread all over the house.

We wonder why we should put filters in a warm-air heating unit to collect the dust being distributed in the home and then use dust spreading floor registers. We feel that this method of distribution will set the warm-air heating industry back many years.

J. L. ANTONIO, Denver, Colo., inquired about the possible effect of the concrete, or the moisture which might collect in the ducts, if the ducts were made of fiber and completely encased in concrete. He stated that the *Denver Building Department* had not yet enacted any ordinance or code covering perimeter or radial systems because it was believed that these systems were still in an experimental stage.

P. W. YOUNG, Denver, Colo., asked for additional information on the various types of duct materials such as fiber, concrete, tile, clay-tile and metal ducts.

W. W. GREILING, Cleveland, Ohio: I think it is very poor public policy for a public official to take the attitude expressed by Mr. Oslund resulting in the banning of certain types of heating systems. Even though a system might not be considered by some people to be a good heating system, anybody who wants it is entitled to spend his money for the system. The American system of free enterprise implies that any man who wants to spend his money may spend it for something he wants. That is the accepted practice of free men in a democratic country, and it has resulted in progress and a high standard of living for all of us. To set up such a standard of arbitrary exclusion of certain types is un-American. The fact that several installations of this system were not adequately designed or correctly installed is no reason for some city official to condemn all perimeter systems and to advocate that nobody shall be allowed to install them even though installed correctly.

F. J. NUNLIST, JR., Milwaukee, Wis., stated that he would make some replies to the discussers, but that the final closure would be prepared by the authors. He pointed out that the object of the test was really to compare the loop and the radial system, and consequently it was not necessary that the type of construction should be of high quality. He noted that the floors were warmer in the perimeter-loop installation, and consequently would expect that more fuel would be used to compensate for the increase in comfort resulting from warmer floors.

In these experiments the type of construction was of low standard because it was desirable to determine whether a poorly constructed house could be heated satisfactorily with the type of system used.

While admitting that many perimeter systems installed had failed to operate properly, Mr. Nunlist advocated that an opportunity should be given for improvement of installation practice in order to open the way for progress rather than to pass laws prohibiting installation. He stated that, for instance, no one would pass ordinances ruling out fireplaces in living rooms because they failed to heat the house adequately.

In conclusion, Mr. Nunlist remarked that the *National Warm Air Heating and Air Conditioning Association* as well as the manufacturers were well aware of the importance of educating the contractors in the matter of improving construction practice, particularly in the application of insulation.

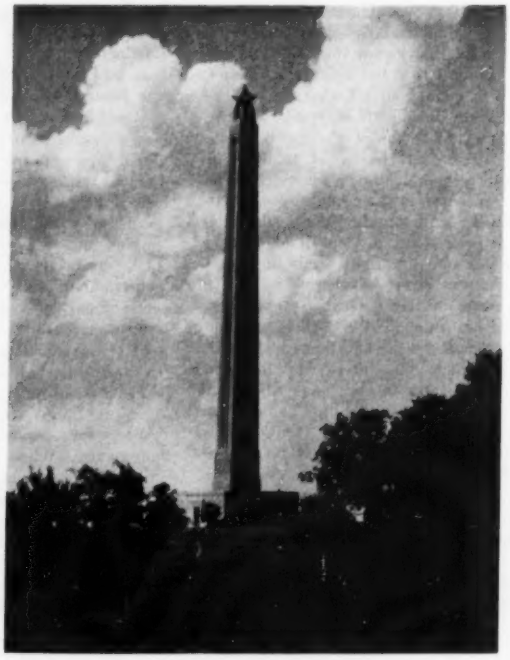
ASHVE TRANSACTIONS INDEX

Copies of the Index to Transactions covering Vols. 1 to 56 (1895-1950) inclusive are now available at the Society headquarters for $1.50.

At its meeting of June 27, 1953 the Council approved the offering of the first Transactions Index (1895-1929) and the new index (1930-1950) to members at the price of $1.50. The combined index offers a complete listing by subject of all papers presented at Society meetings, in addition to a chronological listing by volume.

ASHVE 60th Annual Meeting in Houston January 1954

Rice Hotel



San Jacinto Monument

HOUSTON, TEXAS, largest city of the South, will be the scene of the 60th Annual Meeting of the Society, January 25-27, 1954. Registration headquarters will be established at the Rice Hotel.

The Committee on Arrangements is developing a program to give a *good old Texas welcome* to the visiting members, guests, and their families. Despite what you may have heard about Texas, no passports are required to visit Houston.

The 60th Annual Meeting will present a variety of technical papers according to Prof. B. H. Spurlock, Jr., chairman of the Program and Papers Committee. These will probably include automobile air conditioning, panel heating, summer cooling, cooling load, cooling towers, air distribution, the heat pump, and physiological reactions to environment.

Houston, whose population today is well over 600,000, was first settled in 1824 by John Richardson Harris, a wealthy New Orleans merchant who established a trading post on Buffalo Bayou. In 1826 the town of Harrisburg was laid out and by 1829 was the commercial and trading center of the area. The growing town was destroyed in 1836 by the armies of Santa Anna, but rebuilding began only four months later. Houston, as the city was now called, became the capital of the Republic of Texas, and the Texas Congress met on the site where the Rice Hotel now stands until 1839, when the seat of government was removed to Austin.

The Port of Houston, today the nation's second largest deep sea port, was established in 1841 and the first locomotive arrived in 1853. Today Houston is served by a network of six major railroads with through service to most major cities and nine

Committee on Arrangements

D. M. Mills, *General Chairman*
R. J. Salinger, *Vice-Chairman*

Banquet—W. N. Pauley, *Chairman;* J. A. Wheeler, D. M. Robinson, A. B. Ullrich, A. M. Chase, Jr., J. N. Powell.

Entertainment—F. M. Neil, *Chairman;* N. L. Brown, D. S. Freese, M. E. Linn, H. E. Hope, Jr., O. G. Rivoire, Wesley Brown, D. C. McNeil, Reese Brentzel, H. R. Safford.

Finance—A. J. Natkin, *Chairman;* Willard Ammons, J. A. Poole.

Ladies—C. L. Fleming, *Chairman;* C. C. Quin; Mmes. A. F. Barnes, C. V. Chenault, D. S. Cooper, B. P. Fisher, C. L. Fleming, E. G. Floeter, J. C. Fontana, G. D. Hines, J. W. Holland, J. C. Lewis, D. M. Mills, I. A. Naman, E. H. McLane, F. M. Neil, W. N. Pauley, Dana Price, C. C. Quin, O. G. Rivoire, R. J. Salinger, W. A. Sharp, R. F. Taylor, A. P. Ullrich.

Honorary Chairmen
C. R. Gardner, Fort Worth, W. E. Long, Austin

Publicity—B. P. Fisher, *Chairman;* Wayne Holland, W. J. Way, II, B. J. Beaird, C. W. Warren.

Reception—E. G. Floeter, *Chairman;* Sidney Bromberg, H. O. Williams, J. C. Lewis, M. B. Peiser, G. T. Kerbow.

Sessions—I. A. Naman, *Chairman;* J. B. Buckley, W. L. Lashley, Jr., Bruce Appling, J. C. Fontana, Dallas Sullivan, G. D. Hines, Norman Rosenberg, S. F. Atlas.

Special Events—H. W. Broadwell, *Chairman;* B. P. Fisher, D. S. Cooper, F. R. Young, J. H. Stephenson, M. B. Peiser, H. G. McKee.

Transportation—A. F. Barnes, *Chairman;* A. E. Hess, C. V. Chenault, A. B. Banowsky, R. S. Sandifer, D. W. O'Brient.

D. M. Mills
General Chairman

R. J. Salinger
Vice Chairman

airlines flying to all points in North and South America.

In 1900 the population of Houston was still only 44,600 but the discovery of oil in nearby areas shortly after brought a great boom to the city. Oil discovery combined with the opening of Port Houston in 1914 and the dredging of the Ship Channel to 30 feet in 1919, made for tremendous growth. Dozens of great oil, chemical and other industrial plants burgeoned from 1920 on, bringing great prosperity and swelling population.

With all its booming economy and commercial enterprise cultural and spiritual values have not been overlooked in Houston. Almost 800 churches qualify the city for the title "City of Churches". An excellent art museum, the well known Houston Symphony under Efrem Kurtz, and libraries and theaters give Houston a rich cultural background. The Texas Medical Center encompassing 163 acres of wooded parkland and an investment in buildings and equipment of over $50,000,000 has become the Southwest's greatest medical center. Among the schools in this area are Rice Institute, University of Houston, Baylor University School of Medicine, University of Texas School of Dentistry and Texas Southern University.

Among the many scenic attractions available to the visitor are the San Jacinto Battlegrounds, 20 miles east of Houston, where General Sam Houston defeated the Mexican armies under General Santa Anna. Here the San Jacinto Monument towering 570 feet memorializes the men who died here. The former U. S. Navy battleship Texas is also moored here on a small estuary, retired in dignity after its years of faithful service.

The Committee on Arrangements headed by General Chairman D. M. Mills and Vice Chairman R. J. Salinger is planning an interesting group of activities in connection with the meeting. In addition to the Annual Banquet and local sightseeing and inspection trips members may wish to take advantage of the opportunity to arrange a post meeting trip. There will be a complete schedule of activities and diversions for the ladies under the direction of C. L. Fleming, Chairman of the Ladies Committee.

Houston, as the Southwest's largest city, is a natural gateway to Mexico, Havana, Jamaica and the entire Caribbean and Central American area.

Houston, convention city of the Southwest, and the members of South Texas Chapter of the Society look forward to welcoming the ASHVE to the "fastest growing city in the country" in January, 1954.

Typical *Round Trip* First Class Railroad and Airline Fares to Houston

Airline*

Atlanta, Ga.	$109.48
Baltimore, Md.	188.95
Boston, Mass.	235.87
Charlotte, N. C.	137.66
Chicago, Ill.	147.78
Cleveland, Ohio	167.10
Detroit, Mich.	167.33
Indianapolis, Ind.	132.14
New Haven, Conn.	221.15
New Orleans, La.	45.89
New York — Newark	212.75
Philadelphia, Pa.	199.99
Pittsburgh, Pa.	175.15
Washington, D. C.	183.54

* Tax included

Railroad

	Round Trip* First Class	One-Way* Lower Berth Pullman
Albany, N. Y.	$134.53	$ 19.09
Atlanta, Ga.	66.76	10.24
Baltimore, Md.	115.35	16.68
Boston, Mass.	155.41	21.22
Buffalo, N. Y.	120.46	18.06
Charleston, S. C.	89.53	13.28
Chicago, Ill.	74.41	13.74
Cincinnati, Ohio	76.82	13.74
Cleveland, Ohio	102.98	16.22
Columbus, Ohio	88.76	14.49
Dallas, Tex.	16.73	5.75
Dayton, Ohio	82.36	14.49
Denver, Colo.	71.10	13.33
Des Moines, Ia.	64.29	13.75
Detroit, Mich.	98.90	15.53
Grand Rapids, Mich.	93.59	18.29
Greensboro, N. C.	95.05	15.53
Indianapolis, Ind.	77.65	13.74
Jackson, Miss.	37.26	7.53
Kansas City, Mo.	50.07	10.24
Little Rock, Ark.	34.56	7.07
Los Angeles, Calif.	118.34	19.09
Memphis, Tenn.	43.82	8.74
Milwaukee, Wis.	80.10	16.79
Minneapolis, Minn.	82.17	15.87
Montreal, Canada	145.25	20.82
New Haven, Conn.	142.05	20.18
New Orleans, La.	$ 24.96	$ 5.75
New York, N. Y.	134.53	19.09
Norfolk, Va.	112.13	16.68
Oklahoma City, Okla.	30.13	5.41
Omaha, Nebr.	62.96	12.26
Ottawa, Canada	138.12	22.66
Philadelphia, Pa.	125.20	18.46
Pittsburgh, Pa.	108.16	16.68
Portland, Ore.	138.35	26.80
Sacramento, Calif.	121.96	20.18
St. Louis, Mo.	60.26	11.04
Salt Lake City, Utah	101.78	19.09
San Antonio, Tex.	15.58	5.75
San Francisco, Calif.	121.96	20.18
Seattle, Wash.	138.35	26.80
Shreveport, La.	17.19	5.75
Spokane, Wash.	163.47	From Portland or Seattle
Syracuse, N. Y.	134.53	19.09
Toronto, Ont.	117.76	18.06
Tulsa, Okla.	36.05	7.53
Vancouver, B. C.	146.05	From Seattle
Washington, D. C.	115.35	16.68
Wichita, Kan.	41.12	8.74

* The 15% Federal Tax has been included in these fares.

NOMINATIONS FOR 1954

Officers and Council

The Nominating Committee, selected in accordance with the provisions of **Article VIII** — *Section 3* of the By-Laws, has submitted the following nominees for Officers and members of Council for 1954:

President
LOUIS N. HUNTER, Johnstown, Pa.

First Vice President
JOHN E. HAINES, Minneapolis, Minn.

Second Vice President
JOHN W. JAMES, Chicago, Ill.

Treasurer
E. R. QUEER, State College, Pa.

Members of Council *(Three-Year Term)*

JOHN H. FOX, Toronto, Ont., Canada
ARTHUR J. HESS, Los Angeles, Calif.
C. H. PESTERFIELD, East Lansing, Mich.
BENJAMIN H. SPURLOCK, JR., Boulder, Colo.

Respectfully submitted,
NOMINATING COMMITTEE
C. B. Gamble, *Chairman*
B. W. Farnes, *Vice Chairman*
T. C. Caskey, *Secretary*

M. W. Bishop	H. R. Limbacher
Harry Horowitz	G. S. Murray
Fred Janssen	H. E. Russell
C. W. Leek	T. H. Smoot

Alternates
G. T. Donceel
W. A. Grant

In accordance with the provisions of the Society's By-Laws, ballots containing the names of the above candidates will be sent to the membership prior to the Annual Meeting in January.

Article VIII

Section 4. Other Nominations. Nominations of officers and members of the Council, other than those nominated by the Nominating Committee, and nominations of members of the Committee on Research, other than those nominated by the Council, may be made in writing by at least fifty (50) members eligible to vote, upon presentation of such nominations, with each nominee's consent, to the Executive Secretary at least sixty (60) days prior to the opening of the first session of the Annual Meeting, whereupon the nominees' names shall be placed upon the ballot with a notation that they are presented by members independent of the Nominating Committee.

Section 5. Voting. Voting at any meeting may be in person or by proxy, but only the Executive Secretary and MEMBERS of the Society shall be eligible to act as proxies. Proxies shall not be valid for more than three (3) months from dates of execution. The Executive Secretary and the MEMBERS acting as proxies shall hold the ballots of their principals secret and confidential. Voting for election of officers, Council members, members of the Committee on Research, on proposals to amend these By-Laws, and on questions required to be referred to the Society pursuant to *Article V, Section 2,* shall be by secret ballot. In the event of any tie vote, the Council shall decide the vote.

Section 6. Ballots. Together with notice of the Annual Meeting, the Executive Secretary shall forward appropriate proxies and ballots to members entitled to vote. The proxies and ballots shall contain spaces for write-in names.

Members of Committee on Research

The election of the Committee on Research is governed by the By-Laws for the election of Officers, with the exception that members of the Committee on Research are nominated by the Council.

In accordance with the provisions of **Article VII** — *Section 3 (h)* the Council announces the nomination of the following members of the Committee for election to succeed those members whose present terms expire January 1954.

Committee on Research *(Three-Year Term)*

JOHN EVERETTS, JR., Philadelphia, Pa.
WALTER F. FRIEND, New York, N. Y.
CARL F. KAYAN, New York, N. Y.
HOWARD R. LIMBACHER, Kalamazoo, Mich.
EDWIN F. SNYDER, JR., Minneapolis, Minn.

Article VII

Section 3. General Committees. (h) Committee on Research, consisting of fifteen (15) MEMBERS, nominated by the Council or as provided in *Article VIII, Section 4,* and elected by the Society in the manner of elected officers. .....

NOMINEES FOR 1954 OFFICERS

For President—L. N. HUNTER, vice president of research, The National Radiator Co., Johnstown, Pa., was born August 27, 1903, in Brampton, Ont., Canada, where he received his preliminary education and attended the University of Toronto, receiving his degree of B.A.Sc. in 1925.

L. N. Hunter
Johnstown, Pa.

He began his career with the Bryant Heater Co., Cleveland, Ohio, as assistant research engineer. He served in this position for four years and then joined the staff of The National Radiator Co. as gas engineer, assigned to the design and testing of gas-fired home heating boilers and controls, and also to the design and testing of special cast-iron, gas-fired boilers for treating crude oil emulsions.

Mr. Hunter was made assistant manager of the firm's research department in 1932. In this capacity he supervised the design, test and research work on coal, oil and gas-fired boilers, oil burners, stokers, radiators, convectors and air conditioning equipment, and accessories and controls.

In 1935, he was named manager of the Research Department and in 1941 was appointed vice president and manager of research, and since 1943 he has served on the Board of Directors.

Mr. Hunter joined the ASHVE in 1935 and served on Technical Advisory Committees on Radiation and Comfort, and on the Solid Fuels Committee from 1939 to 1942 and again in 1947. He was a member of the TAC on Panel Heating and Cooling from 1948 and is serving on the current committee. In 1948 and 1949, he served as chairman of the Society's Committee on Research and as a member of its Executive Committee in 1946, 1947 and 1950; and as its chairman in 1948-49. He was a member of the TAC on Combustion in 1950. He has been a member of the TAC on Hot Water and Steam Heating since 1950.

Elected to Council in 1951, Mr. Hunter served on its Executive Committee, in 1952 he was elected second vice-president and first vice-president in 1953. He is currently serving on the Executive Committee of Council, as chairman of the Society's Standards and F. Paul Anderson Committees and member of the Special Committee on Exposition Rates.

Mr. Hunter also is a member of the *American Society of Mechanical Engineers* and is serving on its Heating Boiler Code Committee; *American Chemical Society; American Gas Association; Air Pollution Control Association of America; American Society for Metals; American Ordnance Association;* the Sunnehanna Country Club; and the Bachelors Club.

Listed in *Who's Who in America* and *Who's Who in Engineering*, he has served on committees of the *Institute of Boiler and Radiator Manufacturers;* the *Steel Boiler Institute;* the *Oil Heat Institute of America;* and the *Gas Appliance Manufacturers Association.*

For First Vice President—JOHN E. HAINES, vice president, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., has spent almost his entire career with the company in various capacities. Mr. Haines has served the Modutrol Division as manager of the New York office and assistant manager of its Minneapolis division; manager of the National Regulator Division, Chicago; in 1940 was made manager of the Commercial Controls Division, and a vice president in 1945. He is presently in charge of the Commercial Controls Division in Minneapolis.

John E. Haines
Minneapolis, Minn.

Mr. Haines was born in Noblesville, Ind., on November 8, 1903, attended Purdue University, and was graduated in 1925 with a B.S. in chemical engineering.

He joined the Society in 1940 and served as general chairman of the Committee on Arrangements for the Semi-Annual Meeting held in Minneapolis in 1949. He has also served on the following Society committees: Chapter Delegates, 1945-46; Nominating, 1945-46 and 1948, serving as chairman in 1947; Chapter Relations, chairman, 1950-51; Ways and Means, 1951; Membership, 1951-52, serving as chairman in 1952; and Promotion of Research, chairman, 1947-49. Mr. Haines, a member of Council since 1950, was elected second vice president in 1953. He is currently serving on the Society's Finance Committee and as chairman of its Long-Range Planning Committee.

A member of the Minnesota Chapter, Mr. Haines served as its presi-

dent and vice president in 1946-47 and 1945-46 respectively. He has written and lectured extensively on automatic controls and their applications and has recently completed a textbook on *Automatic Control of Heating and Air Conditioning* which was published this year. He is a member of the *ASME, ASRE, National Sales Executives,* and the Delta Chi Fraternity.

For Second Vice President— JOHN W. JAMES, vice president of research, McDonnell & Miller, Chicago, Ill. is also known to many members for his eight years as technical secretary with ASHVE.

Following graduation from Oregon State College in 1928, Mr. James was

John W. James
Chicago, Ill.

associated with a consulting engineer specializing in heating and ventilating in Portland. Four years later he was awarded a research fellowship at the University of Wisconsin where he received an M.S. degree in 1934 and then entered the research field through General Electric Co. in Schenectady, N.Y. His activities have included three years as instructor and research adviser at the Polytechnic Institute of Brooklyn and for five years before joining the McDonnell & Miller organization he participated in design and development work with Iron Fireman Manufacturing Co. in Cleveland.

He is co-author of the textbook, *Heating and Air Conditioning*, by Allen, Walker and James, and was a contributor to the 12th edition of *Kent's Mechanical Engineers' Handbook;* was associate editor of the 1949 edition of the *Handbook of Oil Burning;* served as technical editor of THE GUIDE from 1936 to 1943, and is author of a long list of articles in engineering publications.

In 1950 Mr. James was elected to a three-year term on Council where he served as chairman of the Finance Committee in 1952, and chairman of the Program and Papers Committee in 1949. He was also appointed for a term as chairman of the Publication Committee, and has served as a member of the Society's Constitution and By-Laws, Nominating, Publication Policy and Guide Publication Committees. He was elected to two terms on the Committee on Research, serving as vice chairman in 1949, from 1950 to date he served as chairman of the TAC on Hot Water and Steam Heating, and from 1949-52 as a member of the TAC on Panel Heating and Cooling. He is currently serving as a member of the Executive and Finance Committees of Council, the Long-Range Planning Committee, and as a member of the TAC on Physiological Research.

He is now affiliated with the Illinois Chapter of ASHVE, and was president of the Northern Ohio Chapter in 1947. He is a registered professional engineer in the States of Oregon and Ohio and also is a member of Sigma Xi, Pi Tau Sigma, Phi Sigma Kappa, *Western Society of Engineers, American Society of Sanitary Engineers* and is active on the Research Committee of the *National Association of Manufacturers.* Mr. James is also a member of the *American Society of Mechanical Engineers* and is serving on its Heating Boiler Code Committee.

For Treasurer—E. R. QUEER, director and professor of engineering research, The Pennsylvania State College, State College, Pa., was born on May 26, 1904, in Johnstown, Pa. Professor Queer received his B.S. and M.S. Degrees in electrical engineering in 1926 and 1928, from The Pennsylvania State College. He has been associated with the College in the field of research since graduation and served on the faculty since 1926. During his 22 years on the engineering faculty, Professor Queer has conducted extensive research, particularly in the fields of heat and moisture transfer, thermodynamics, adsorption by chemical desiccants, and in housing. He was appointed director of engineering research on September 1, 1952. He is also a consultant to the Chief of Army Ordnance, the Bureau of Yards and Docks of the U. S. Navy, and the Pittsburgh Lectrodryer Corp., and the Insul-Mastic Corp. of America on long-term storage and preservation of military material, and the U. N. Permanent Headquarters on Condensation Control in the U. N. Buildings.

E. R. Queer
State College, Pa.

Professor Queer joined the Society in 1933 and has been an active member, serving as a member of Council since 1950. He has also served on many Society committees such as; Federal Liaison, 1949; chairman, Program and Papers, 1951 and 1952; Admission and Advancement, 1945-47, serving as chairman from 1947-48; Committee on Research, 1948-50; TAC on Navy Studies, 1948; and TAC on Air Sterilization, and Means Committees, and is currmember of the Finance and Ways 1948. In 1952-53 he served as a rently serving as chairman of the latter. During 1939-49 he also served on the TAC on Insulation.

He is also a member of the *Society of Naval Architects and Marine Engineers*, United States Naval Institute, *Society of Naval Engineers*, *American Society for Testing Materials*, Sigma Xi and Theta Xi fraternities.

As a member of the U.S. Navy Reserve, he served for five years in World War II in the Air Conditioning Section of Bureau of Ships, receiving a commendation from Adm. Chester A. Nimitz. He has held the rank of commander since March 1944. Professor Queer is a registered professional engineer in the State of Pennsylvania and has written many books and papers, some of which have been published in both the Society's JOURNAL and TRANSACTIONS.

NOMINEES FOR COUNCIL — 1954

(Three-Year Term)

JOHN H. FOX, general sales manager, Minneapolis-Honeywell Regulator Co., Ltd., Toronto, Ont., Canada, is a registered professional engineer and an active member of the Ontario Chapter of ASHVE.

J. H. Fox
Toronto, Ont., Canada

Born on May 24, 1903 in Toronto, Mr. Fox was educated in Toronto public schools, the Central Technical School in Toronto and was graduated from the University of Toronto in 1927 with a B. A. Sc. degree in mechanical engineering. The following year he was employed by the University as a demonstrator in its Hydraulics Laboratory.

Prior to his association with the Minneapolis-Honeywell Regulator Co., Mr. Fox worked for the C. A. Dunham Co., Ltd., from 1928 to 1934 as assistant to the chief engineer. He joined Minneapolis-Honeywell in 1935 as a sales and application engineer.

During World War II, Mr. Fox, a Lieutenant Colonel with the Royal Canadian Electrical and Mechanical Engineers, served with the British 2nd Army in Europe and was decorated with the Order of the British Empire. After the war in 1946 he rejoined Minneapolis-Honeywell as sales manager of Commercial Controls Division, and in 1951 he became manager of the Central Region. He was named general sales manager in January of this year.

Mr. Fox became a member of the Society in 1935 and was elected president of the Ontario Chapter in 1950. He served on the chapter's Board of Governors during 1938-39 and 1946-48 and was elected vice president in 1949. He has also been active on the following ASHVE committees: Chapter Delegates, 1949; Chapters Conference, 1950 and 1952; Program and Papers Committee, 1951-52, and Chapter Relations Committee, 1950. He was elected to a three-year term on the Council in 1951 and is currently a member of the Public Relations Committee.

Among the other organizations in which Mr. Fox holds active membership are the *Association of Professional Engineers of Ontario, Engineering Institute of Canada; Institution of Mechanical Engineers*, London, England; *Royal Canadian Military Institute* and the Toronto Board of Trade. He is a past master of the University Lodge, *A. F. & A. M.*, Toronto.

ARTHUR J. HESS, president, Hess-Greiner & Polland, Los Angeles, Calif., and president of Heat & Power Equipment Co., Long Beach, Calif., has been a sales representative for engineering products since 1937. His interest in the application of these products resulted in work on such notable projects as the stages at the 20th Century-Fox Studio; the heating, ventilating and air conditioning for the Co-op wind tunnel at Pasadena and at Curtiss-Wright, and the Earhart Research Laboratory, California Institute of Technology.

A. J. Hess
Los Angeles, Calif.

Mr. Hess was born in Pasadena in 1904. He attended grammar school and high school in Los Angeles and from 1923 to 1928 studied civil engineering at the University of California at Los Angeles and at Berkeley and the University of Southern California. In 1928 he entered business as a plumbing and heating contractor. From 1930 to 1936 he was a consulting engineer, concurrently teaching night courses for the Los Angeles Board of Education.

A member of ASHVE since 1937, Mr. Hess has been an active leader of the Southern California Chapter. He was elected president of the chapter in 1941, having served in 1938

as treasurer, in 1939 as secretary and in 1940 as vice president. He has also served on the following committees of the Society: TAC Sensations of Comfort, 1949-53; Committee on Promotion of Research, 1949; TAC on Corrosion, 1950; Chapter Relations Committee, 1950-52 and the Committee on Research, 1950-53; and the TAC on Air Cleaning 1951-53. He was chairman of the Chapters Conference and TAC on Plant and Animal Husbandry during 1952, and is current chairman of the latter as well as chairman of TAC on Evaporative Cooling. Mr. Hess is also a member of the Society's Special Long-Range Planning Committee.

Other societies, clubs and fraternal organizations to which Mr. Hess belongs are: *American Society of Refrigerating Engineers, Air Pollution Control Association*, Masons, Shriners, Kappa Alpha, and Chi Epsilon.

Mr. Hess is the author of several articles, including *Air Conditioning in Moving Picture Studios, Evaporative Cooling, Air Conditioning in Film Laboratories* and *Plant Research in the Phytotron.*

CHARLES H. PESTERFIELD, professor of mechanical engineering, Michigan State College, East Lansing, Mich. was born in 1907 in Van Buren, Ark. He attended the Ozark High School, Ozark, Ark., and was graduated from the University of Arkansas in 1931 with a B.S. degree in mechanical engineering. Prior to graduation, he worked as a research assistant for the university in its experimental engineering laboratory.

C. H. Pesterfield
East Lansing, Mich.

During 1932-33, he did graduate work at the University of Minnesota as an ASHVE research fellow. In 1933 he received his M. S. degree in mechanical engineering.

The following year, Professor Pesterfield was appointed an instructor of mechanical engineering at the University of North Dakota. From 1935 to 1938 he was acting head of the University's Department of Mechanical Engineering. In the latter capacity he supervised the design and installation of the departmental power plant. In 1938 he accepted an appointment as instructor at Michigan State College. Subsequently, he has held an assistant professorship, associate professorship, and is currently a full professor in charge of refrigeration and heating and air conditioning option.

He has been management consultant for several industries, banks, department stores since 1944, and at present is consultant for Tranter Mfg. Inc.

Professor Pesterfield joined ASHVE in 1932 and has been active on the following committees of the Society: Admission and Advancement in 1940, Nominating Committee, 1945-47 and chairman in 1949; Chapter Delegates Committee alternate, 1945-46 and 1948; Chapter Delegates Committee member, 1947; and Chapter Relations Committee, 1948 and 1953.

He is affiliated with the Western Michigan Chapter and has served on the chapter's Board of Governors for three years: 1940, 1941 and 1944. He was elected secretary of the chapter in 1939, vice president in 1942 and president in 1943.

Other societies and fraternal organizations of which Professor Pesterfield is an active member are *American Society for Engineering Education*, Sigma Xi and Tau Beta Pi.

BENJAMIN H. SPURLOCK, JR., associate professor of mechanical engineering, University of Colorado, Boulder, Colo., was director of the University's graduate studies, Depart-

B. H. Spurlock, Jr.
Boulder, Colo.

ment of Mechanical Engineering, from 1946 to 1951, and is currently chairman of the department's Laboratory Committee. In addition to his work in the educational field, he has also gained recognition as a consultant engineer. During World War II he worked on a special project for Pratt & Whitney Aircraft, and since 1947 has been a research associate and consulting engineer for the Air Material Command.

Professor Spurlock was born July 19, 1907 in Lithonia, Ga. Prior to graduating from the Georgia Institute of Technology in 1938 with a B. S. degree in engineering, he was employed as an accountant for Southern Railway, Atlanta, Ga., as a sales engineer for the Union Oil Co. of California and as a design engineer for Eagan Cotton Mills, Atlanta. In 1939 he received an M. S. degree from Massachusetts Institute of Technology, continuing his studies at the University of California the following year. In 1940 he accepted a position as instructor of engineering at the University of Colorado.

An instructor from 1940 to 1942, Professor Spurlock was appointed an assistant professor in 1942. In 1944 he accepted an invitation to lecture on mechanical engineering at Yale University, New Haven, Conn., returning to the University of Colorado in 1946. He was made an associate professor of mechanical engineering in 1947.

Professor Spurlock has been a member of ASHVE since 1944. He was elected a member of the Council in 1951 and has served the Society in the following capacities: member of the Committee on Codes and

Standards, 1951-53; chairman of the Program and Papers Committee, 1953; honorary chairman, Semi-Annual Meeting, 1953; and Chapters Conference Committee alternate, 1953. An active member of the Rocky Mountain Chapter, he has been a member of its Board of Governors since 1950. He was elected vice president of the chapter in 1950 and president in 1951.

Professor Spurlock is also active in several other organizations. As a member of *ASME* he has served on its Committee on Theory and Fundamental Research; as chairman of the Heat Transfer Division; and honorary chairman, Student Branch. His activities with *ASEE* have included membership on the editorial board, *Heat Power News*, and the Institution Committee on Evaluation of Engineering Education. He is also ASHVE representative on the Colorado Engineering Council, and a member of the Board of Examiners, City of Denver, Sigma Xi and Pi Tau Sigma.

Professor Spurlock is the author of several articles, the latest of which, *Performance of Forced Draft Cooling Tower*, published in the ASHVE JOURNAL SECTION June 1953. He is listed in *Who's Who in Engineering*, *Who's Who on Pacific Coast* and *American Men of Science*.

NOMINEES FOR COMMITTEE ON RESEARCH 1954

(Three-Year Term)

JOHN EVERETTS, JR., consulting engineer with Charles S. Leopold, Philadelphia, Pa., was born in 1905 in Brooklyn, N.Y. and received his M.E. degree from Brooklyn Polytechnic Institute in 1929.

Mr. Everetts was associated with W. L. Fleisher & Co., Inc., N.Y., from 1923-25 in the designing and testing field and remained with that company, while attending school, from 1925-29, working during the summer months only. Upon graduation he joined the Richardson & Boynton Co. of Dover, N.J. and was in charge of their research laboratory. From 1933-38 he was secretary-treasurer of the Air & Refrigeration Corp., New York, N.Y. He was employed as sales engineer with the Frigidaire Division of General Motors Sales Corp., Dayton, Ohio, from 1939-41. The following year was spent with Blaw-Knox Co., Blawknox, Pa.

John Everetts, Jr.
Philadelphia, Pa.

Mr. Everetts was commissioned a Lieutenant in the Naval Reserve in 1942 and was assigned to duty in the Bureau of Ships, where he served as West Coast representative of the Air Conditioning Section. He was promoted to the rank of Lieutenant Commander in 1944 and Commander in 1945. Upon his return to civilian life in 1946, he formed a partnership with T. H. Urdahl, Urdahl & Everetts, consulting engineers, Washington, D. C. and San Francisco, Calif. He joined the staff of Charles S. Leopold as consulting engineer in 1949.

An active member of the Society, Mr. Everetts has served on the following Research Technical Advisory Committees: Refrigeration in Relation to Air Treatment; Summer Air Conditioning for Residences; Weather Design Conditions; Cooling Load in Summer Air Conditioning; Sensations in Comfort; Panel Heating and Cooling; and Sorbents. Currently he is serving on the Research Executive Committee, Long-Range Research Program, TAC on Cooling Load, chairman of the TAC on Weather Data, vice chairman of both TAC on Sensations of Comfort and TAC on Sorption, and a member of the TAC on Panel Heating and Cooling and TAC on Plant and Animal Husbandry. He was on the Board of Governors of both the Golden Gate Chapter and the Washington, D.C. Chapter. Mr. Everetts is also a member of the *ASRE* and the Philadelphia Engineers Club.

He is the author of many technical papers and is a lecturer on the engineering staff at Columbia University.

WALTER F. FRIEND, mechanical engineer, Ebasco Services, Inc., New York, N.Y., is a consultant on electric power generation and utilization for electric utility companies, as well as technical advisor on atomic energy development for power generation and industrial applications and other research and development activities.

His career has included a wide scope as consulting engineer in such fields as: natural gas utilization; district steam utility systems; heating and air conditioning; refrigeration engineering; the electric heat pump; automotive equipment and

W. F. Friend
New York, N.Y.

transport facilities; and fire protection for utility company properties.

Born in 1891 in Detroit, Mich., Mr. Friend received his B.M.E. degree from the University of Michigan in 1913. After graduation he joined the United States Rubber Co. organization at Detroit, Mich., as a power engineer and remained there until 1915 when he was assigned to the India Rubber Co., New Brunswick, N.J. From 1916-19 he was a mechanical engineer with Gibbs & Hill, New York, N.Y., and from 1919-25, a designing engineer with Walter Kidde, New York, N.Y. He joined the Ebasco staff in 1925.

Mr. Friend became a member of the Society in 1941 and has served on the TAC on Cooling Load, 1942-53 and the TAC on Heat Pump, 1949-53. He contributed to THE GUIDE 1953 and is the author of more than 20 technical papers and articles, including recently *Load Characteristics and Economics of Electric House Heating, Modulating and Load Limiting Controls for Electric Heating, Progress on Electric Heat Pump Development, and Prevention of Noise on Public Utility Properties.*

He is also a member of *ASME, AIEE, ASRE, SAE, NDHA,* Edison Electric Institute Committees, *American Gas Association, Air Pollution Control Association, National Farm Chemurgic Council, National Association of Manufacturers'* Committee on Research and Atomic Energy Subcommittee, Atomic Industrial Forum, Inc., and Sigma Chi.

CARL F. KAYAN, professor and executive officer, Department of Mechanical Engineering, Columbia University, New York, N. Y., is noted for his work with thermodynamics, heat transfer, instruments and automatic control, and heating, ventilating and air conditioning.

In his research activities, Professor Kayan has been particularly concerned with the development of the electrical analogue approach in the study of heat transfer processes. He has presented a number of papers before the Society on this subject, the most recent one *Electrical Analogger Application to the Heat Pump Process,* published in ASHVE JOURNAL SECTION, August 1953.

Professor Kayan, born in New York City on July 24, 1899, was graduated from Columbia in 1922 with an A. B. degree, and received his M. E. degree in 1924. The following year he worked at Columbia as a research assistant, investigating heat transfer, and as a teaching assistant in the Department of Mechanical Engineering. Subsequently, he became an instructor and was made an assistant professor in 1937.

Carl F. Kayan
New York, N.Y.

During the early years of his professional career, Professor Kayan conducted general test work on heat transfer equipment, engines and similar machinery for various industrial firms. From 1933 to 1942 he was concerned with general test work and was a consultant engineer for heat transfer operations, heating, ventilating and air conditioning.

A member of ASHVE since 1942, Professor Kayan has served on various committees, including: TAC Cooling Load, 1944-1953; Heat Pump, 1949-1953; Panel Heating and Cooling, Group A, 1947-1950; Panel Heating and Cooling, Group B, 1951-1953; Guide Publication Committee, 1945-1946, and Chapter Relations Committee, 1950-51. He served as an alternate and member on the Chapters Conference, 1950 and 1951, respectively. He is currently serving as *ASME* representative on the Joint Committee for Revision of Code of Minimum Requirements for Comfort Air Conditioning.

Professor Kayan is affiliated with the New York Chapter of the Society, and was elected vice president of the chapter in 1949, and president in 1950. He served on the chapter's Board of Governors from 1945 through 1947.

Professor Kayan is a past president of the *Instrument Society of America,* and has been active on numerous committees of *ASME* and *ASRE.*

HOWARD R. LIMBACHER, chief design engineer, Ingersoll Products Division, Borg-Warner Corp., Kalamazoo, Mich., was born at Dover, Ohio in 1904. He attended The Ohio State University, Columbus, where he received his B.M.E. degree in 1936.

H. R. Limbacher
Kalamazoo, Mich.

Mr. Limbacher was employed as a research engineer by Battelle Memorial Institute, Columbus, Ohio, from 1935-43. He then joined the staff of the Borg-Warner Corp. as a development engineer in the Ingersoll Steel & Disc Division. Since that time the name has been changed to the Ingersoll Products Division.

He was president of the Western Michigan Chapter in 1952-53 and its vice-president in 1951 and secretary in 1948-49. He served for many years as a chapter delegate and is currently serving as an alternate on the Chapters Conference Committee. Mr. Limbacher also served as a member of the Guide Committee from 1948-50, as well as a member of the Research Technical Advisory Committee on Combustion since 1950 serving on the current committee.

A licensed engineer in the State of Ohio, Mr. Limbacher is the author

of several papers including Performance of Automatic Controls of Small Underfeed Stokers; An Experimental Investigation of the British Standard Method for the Crucible Swelling Test for Coal; The Relation of the Size of Bituminous Coals to their Performance on Small Underfeed Stokers; and The Performance of Several Types of Bituminous Coal on Small Underfeed Stokers.

Listed in both *American Men of Science* and *Who's Who in Commerce and Industry*, Mr. Limbacher is also a member of *ASME, Kalamazoo Engineering Society* and Tau Beta Pi.

E. F. Snyder
Minneapolis, Minn.

EDWIN F. SNYDER, JR., supervisor, Control Application Commercial Division, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., was born on February 14, 1914, in Grand Rapids, Mich., and received his B.S. degree in Mechanical Engineering from the University of Michigan, Ann Arbor, in 1936.

He started his career in 1930 as assistant superintendent and heating engineer with the Rudy Furnace Co. He worked intermittently while attending school and remained with the firm until 1938. From 1940-41 he was superintendent and chief engineer for the Season-Aire Corp. of America. Mr. Snyder served in the Army from 1941-45, supervising the design and construction of eight air bases. He became associated with Minneapolis-Honeywell in 1945 and has been with the company for the past eight years.

Mr. Snyder has been a member of the TAC on Panel Heating and Cooling, Group D, since 1951, serving as chairman from 1952-53. He was president of the Minnesota Chapter in 1951-52, vice president in 1950-51 and secretary from 1948-50.

He has written several articles including Electronic Control Systems; Methods of Zoning and Control Systems for Multiple Family Dwellings; and Control of Radiant Panel Heating. He also co-authored a paper on Field Studies of Floor Panel Control Systems which was presented at the 59th Annual Meeting held in Chicago, January, 1953. In addition he wrote a paper on Control of The Heat Pump published in 1951.

Mr. Snyder is also a member of the Triangle Fraternity, Michigan Chapter, and F & AM.

OCTOBER MEETING FOR OFFICERS AND COUNCIL

The Council holds its Fall meeting in Cleveland, Ohio, October 9, and important actions required at this meeting are the adoption of the 1954 budget, appointment of four Nominating Committee members and an alternate, and action on the recommendations made by a number of committees.

Schedules of chapter visits by Society Officers have been arranged during October, for Pres. Reg. F. Taylor and First Vice Pres. L. N. Hunter.

Between October 5 and 15 President Taylor visits seven chapters, Western New York (Buffalo), Cincinnati, Miami Valley (Dayton), Northern Ohio (Cleveland), North Jersey (Newark), Washington, D. C., and Virginia (Norfolk). The subjects of his talks are *Yesterday, Today and Tomorrow*, which relates to Society activities, and the other, *Some Unusual Situations Encountered in Air Conditioning Design*, which deals with some of his experiences in the air conditioning field.

The chapters of the South and Southwest will be visited by First Vice President Hunter between October 12 and 20, and these will include, Oklahoma (Oklahoma City), Tulsa, Little Rock, and Delta (New Orleans).

L. G. MILLER JOINS *NWAH&ACA* Staff

Lorin G. Miller, former Dean of Engineering, Michigan State College, has recently accepted a position as Technical Consultant for the *National Warm Air Heating & Air Conditioning Association*. Dr. Miller retired from the faculty of Michigan State College July 1.

L. G. Miller

Having established the first Forced Warm Air Heating Short Course at Michigan State in 1931, Dr. Miller became active in *NWAH&ACA* when the association became co-sponsor of College Short Courses in 1934. In his present capacity as Technical Consultant, he will continue as chairman of *NWAH&ACA*'s educational advisory board and as coordinator of the committees responsible for the preparation and revision of its manuals.

Dr. Miller joined the faculty of Michigan State in 1929 as associate professor. He had been associate professor of mechanical engineering at the University of Wisconsin from 1918 to 1923 and Dean of the College of Engineering, Des Moines University, from 1923 to 1929. He was appointed Dean of Engineering at Michigan State in 1948.

A member of ASHVE since 1933, Dr. Miller has served as vice-president and president of the Western Michigan Chapter. He has also served as a member of the Council of the Society and on various of its research Technical Advisory Committees.

Summary of Chapter Meetings

• *IOWA:* The election of officers was held at the Chapter's May meeting with the following men elected for the 1953-54 term: *President*—J. F. Sandfort; *Vice-President*—L. E. Gnade; *Secretary-Treasurer*—G. J. Kraai; *Board of Governors*—R. H. Schnell, W. A. Schworm and H. A. Schwieger. Retiring President Schnell turned the gavel over to incoming President Sandfort.

E. W. Jerger, Department of Mechanical Engineering, Iowa State College, presented a very interesting talk on *Fuels and Combustion.* The history of combustion and typical combustion problems encountered by engineers of today was discussed. An informative discussion period was the result of this most entertaining talk.

The meeting was concluded after the appointment of D. E. Schroeder and R. R. Schilling as an Auditing Committee.

• *NORTHERN* and *SOUTHERN PIEDMONT:* Three days of festivity, fun and fellowship were enjoyed by the members and guests of the Northern and Southern Piedmont Chapters who assembled at Greystone Inn, Roaring Gap, N. C., for their Joint Annual Summer Meeting.

J. A. Rice of the Southern Piedmont Chapter was general chairman; R. O. McGary, golf chairman; L. F. Lawrence, Jr., entertainment chairman; C. Whitmer, banquet chairman; Mrs. R. E. Mason, ladies bridge and canasta chairlady; and W. D. Graham, Jr., represented the Northern Piedmont Chapter.

Special events included Bingo on Friday night, Men's Golf Tournament, Saturday morning; Ladies Bridge and Canasta, Saturday morning. Saturday afternoon was left free for swimming, sight-seeing, tennis, and more golf. A social get-together and banquet, accompanied by music and dancing, was enjoyed by everyone on Saturday evening.

After a buffet lunch on Sunday, the meeting was adjourned and a happy group of approximately 90 people, returned home. Members from both Chapters helped to make this a very memorable weekend.

• *SOUTHWEST TEXAS:* Pres. D. E. Locher called the August meeting to order at the Officers Club of the Naval Air Station, Corpus Christi, and following the reading and approval of minutes, a nominating committee was announced as follows: C. A. Mansheim, chairman; T. N. Inglis, Jr., R. W. Kotzebue, and J. L. Rea, Jr. President Locher took this opportunity to appoint a By-Laws Committee, comprised of the following members: I. W. Wilke, chairman; F. B. Frazee, L. S. Pawkett, G. R. Rhine, and W. C. Saunier.

The honored guest of the evening, was L. S. Pawkett, one of the organizers of the Southwest Texas Chapter.

The speaker of the evening, Dr. Frank Dotterweich of Texas Arts & Industries College, Kingsville, presented an interesting talk on the research work conducted by the college and how the research carried on at Texas A. & I. differed from that of other colleges. Dr. Dotterweich also reported on the development of two stage atmospheric cooling towers, which are stationed on the campus, and gave some details on tests being conducted on absorption and compression type residential air conditioning units involving the use of these cooling towers. An interesting question and answer session took place after Dr. Dotterweich's most valuable discussion.

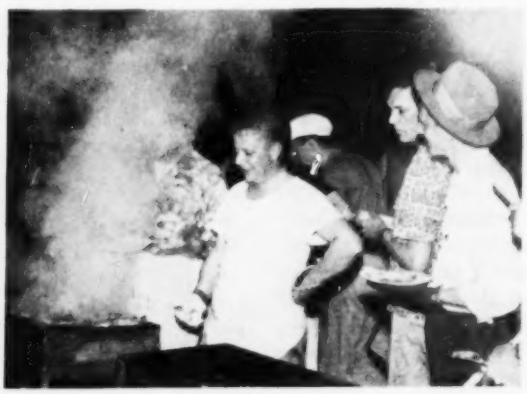
OREGON CHAPTER'S STAG PICNIC

Members and guests of Oregon Chapter layed aside their slide rules, tee squares and assorted tools of their respective trades to attend the annual chapter stag picnic August 7 at Bonnie Lure Park near Portland, Ore.

The festivities got under way at noon with a softball game which lasted until darkness and saw many participants retire early due to aching joints and pulled muscles (including umpires). The horseshoe pits were occupied by casualties from the ball game and those who liked to pace their athletics a little slower.

The highlight of the event came at twilight when a palate pleasing meal featuring charcoal broiled steaks and Indian style baked salmon was served to the hungry throng. A bingo game and group singing rounded out the day's activities.

The annual picnic was attended by 105 members and guests. Chairman Gordon Van Alst was in charge of arrangements and was assisted by Arcade Kendrick, Bill Oscanyan, Jack Wallace, Lee Miller, Wayne Kelly and Ray Wredberg.



"Chowline" waiting for steaks at Oregon Chapter's stag picnic

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 70 applications for membership, including 1 reinstatement; in addition 11 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by October 31, 1953, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement

California

△SCHRYVER, E. J., Design Engr., Aerojet-General Corp., Azusa. REFERENCES: T. A. Ehrisman*, J. P. Harrington*, A. Z. Levine, R. J. McCann.

YATES, R. A., Mech. Designer, R. L. Thompson, Mech. Engr., Long Beach. REFERENCES: C. W. Finn, E. E. Gould, E. R. Hicks, George Rusher.

Colorado

PORTER, L. E., Partner, Lane & Co., Grand Junction. REFERENCES: H. D. Gregory, C. B. Hickey, J. E. McNevin, J. E. McNevin, Jr.

Connecticut

†BAILEY, G. B., Exec. Dir., John B. Pierce Foundation, New Haven. REFERENCES: James Holt, R. J. Lorenzi, E. E. Trickler, H. L. Von Rehberg.

JACKSON, E. C., Factory Field Repr., Radiant-Ray Radiation Inc., New Britain. REFERENCES: W. R. Becher*, D. W. Erickson*, K. S. Parrott*, J. H. Reilly.

LOWN, L. B., Piping Engr., American Cyanamid Co., Stamford. REFERENCES: W. D. Graham, J. M. Pleasants, W. H. Sullivan, Jr., W. H. Sullivan, Sr.

WAELDNER, W. J., Research Engr., Anemostat Corp. of America, Hartford. REFERENCES: A. J. Hess, Fritz Honerkamp, F. J. Kurth, C. M. Wilson.

Florida

TAYLOR, G. E. JR., Field Engr., Mechanical Contractor's Supply Inc., St. Petersburg. REFERENCES: Guy Hall, C. W. McIntyre*, Paul Spellmen*, C. W. Wentz*.

Georgia

ERICKSON, T. W., Owner, Erickson's, Savannah. REFERENCES: F. E. Baird, G. E. Hairston, E. K. Jamison, D. F. Lindstrom.

△LAZENBY, J. M., Partner, Lazenby & Borum, Cons. Engrs., Atlanta. REFERENCES: J. W. Borum, J. S. Edgar, W. M. Garrard, W. J. McKinney.

Illinois

BEST, MICHAEL, Mech. Engr., Kralovec, Mayer & Best, Chicago. REFERENCES: R. J. Abramson, F. A. Balzer, E. A. Davis, E. M. Kralovec, Jr.

HAINES, R. R., Engr., Deere & Co., Moline. REFERENCES: E. H. Beling, C. R. Johnson*, W. G. Kimmel*, W. O. Rice*.

KRULEWITCH, Mech. Engr., The Austin Co., Chicago. REFERENCES: M. W. Bishop, H. G. Gragg, E. P. Heckel, Jr., G. V. Zintel.

MAYER, W. H., JR., Partner, Kralovec, Mayer & Best, Chicago. REFERENCES: E. P. Heckel, Jr., S. R. Lewis, S. I. Rottmayer, R. X. Shields.

Indiana

TESKOSKI, J. M., Comm. Br. Sales Mgr., Minneapolis-Honeywell Regulator Co., Indianapolis. REFERENCES: J. F. Cummiskey, J. E. Haines, C. F. A. Locke, J. S. Locke.

Louisiana

ASHCRAFT, H. C., Dist. Sales Mgr., Curtis Mfg. Co., Baton Rouge. REFERENCES: G. S. Cox, W. I. Pol, F. H. Welk*, C. S. Woodruff.

BENJAMIN, H. S., JR., Design Engr., de Laureal & Moses, Cons. Engrs., New Orleans. REFERENCES: J. S. Adair, J. J. Friedler, Jr., I. A. Lindberg, W. G. Moses.

VEHORN, B. L., Engr., The Powers Regulator Co., New Orleans. REFERENCES: W. W. Carder, E. R. Foss, J. J. Joyce, K. M. Stevens.

Michigan

BOBALJIK, MARKO, Plant Layout & Design Engr., Chrysler Jet Engine Plant, Detroit. REFERENCES: J. B. Freeman, J. L. Garst, J. E. Thomas, E. J. Weiss.

△CANNING, R. S., Owner, Bell Engineering & Supply Co., Three Rivers. REFERENCES: F. W. Casselman*, F. K. Platt, R. B. Smith, B. J. Walter.

CASE, L. L., Engr., Russell & Olson Co., Detroit. REFERENCES: J. N. Livermore, R. V. B. Martelli, D. F. Robertson, P. H. Ziel.

SIEGEL, E. G., Sr. Mech. Engr., Smith, Hinchman, & Grylls, Inc., Detroit. REFERENCES: E. H. Clark, J. B. Freeman, Joseph Vogt*, K. J. Wagoner.

Minnesota

ANDERSON, P. L., Fred Vogt & Co., St. Louis Park. REFERENCES: A. B. Algren, J. V. Borry, E. F. Snyder, Jr., F. G. Vogt.

LOVELAND, T. A., Secy., D. W. Hickey & Co., Inc., St. Paul. REFERENCES: J. A. Craig, D. W. Hickey, J. W. McNamara, R. W. Otto.

Mississippi

FENTON, G. H., Owner, Reliable Piping, Jackson. REFERENCES: C. M. Broad, J. G. Coleman, Jr., H. M. Ludlow, C. W. Whaley.

SMITH, L. H., Dealer Coordinator, Mississippi Valley Gas Co., Jackson. REFERENCES: C. M. Broad, B. M. Myers, Jr., I. E. Rowe, R. E. Vernon.

Missouri

BUTLER, M. E., Designer, E. K. Campbell Co., Kansas City. REFERENCES: E. K. Campbell, R. P. Campbell, W. A. Reichow, A. R. Wolf*.

△GAY, C. E., JR., Design Engr., John D. Falvey, Cons. Engr., St. Louis. REFERENCES: Kirk Campbell, J. D. Falvey, G. W. F. Myers, H. F. Wilson.

△LINIMON, O. G., Appl. Engr., The Marley Co., Kansas City. REFERENCES: W. O. Kretzmeier, L. T. Mart, P. E. C. Massaglia, U. M. Scurlock.

Montana

GORDON, J. S., Mech. Engr., R. L. Prussing, Mech. Engrs., Billings. REFERENCES: J. H. McCabe, R. L. Prussing, H. M. Rowe, L. W. Worthington.

New York

CARVER, W. H., Mgr., W. G. Carver Co., Schenectady. REFERENCES: L. V. Appleby, G. G. Davis, J. E. Hart, J. L. Ottenheimer.

ECONOMIDES, THOMAS, Htg. & Vent. Designer, Voorhees, Walker, Foley & Smith, New York. REFERENCES: J. B. Dietze, H. M. Rudio, H. W. Seelinger, R. L. Stinard.

KAY, STEPHEN, Sales Mgr., J. M. Fink Co., Inc., New York. REFERENCES: A. A. Bearman, Nathan Feder, B. B. Howes, S. H. Spencer.

JOURNAL SECTION

MacGilfrey, K. E., Mgr., B-Ken Service, Rensselaer. References: L. V. Appleby, J. N. Futia, J. L. Ottenheimer, R. J. Tougher.

Nestle, J. D., Designer, Voorhees, Walker, Foley & Smith, New York. References: Maurice Baller*, H. R. Colen, Vincent Gazerro*, J. F. McCaffrey*.

Porter, R. L., Chief Design Engr., Burnham Corp., Irvington. References: A. E. Bastedo, M. K. Fahnestock, W. S. Harris, S. Konzo.

Wilson, R. O., Engr., Minneapolis-Honeywell Regulator Co., New York. References: Ernst Graber, R. J. Lynch, O. F. Quist, Jr., M. W. Wolin.

North Carolina

Bird, W. H., Asst. Mgr., Tomlinson Co., Inc., Greensboro. References: R. K. Hunter, J. M. Pleasants, W. H. Sullivan, Jr., W. H. Sullivan, Sr.

Tomlinson, W. N., Repr., Tomlinson Co., Inc., Greensboro. References: W. D. Graham, Jr., P. L. Guest, Jr., J. E. Hart, R. K. Hunter.

Ohio

Barclay, J. R., Estimating Engr., Becker-Seidel-Clark Inc., Cleveland. References: J. Frizzee*, A. Kenninger*, E. J. Sweeny, A. L. Vanderhoof, Sr.

Bartel, W. L., Gen. Sales Mgr., C. E. Squires Co., Cleveland. References: C. F. Boester, C. M. Burnam, Jr., F. W. Hutchinson, Clifford Strock.

Bowen, S. T., Htg. & Air Cond. Specialist, The Cleveland Electric Illuminating Co., Cleveland. References: J. T. Avery, W. W. Lige, W. R. Moore, E. C. Webb.

Clark, W. J., Vice Pres., Becker Seidel Clark Inc., Cleveland. References: R. L. Clark, E. J. Sable, E. J. Sweeny, J. E. Wilhelm.

Conrad, J. C., Dist. Air Cond. Repr., Worthington Corp., Cleveland. References: Lester T. Avery, J. M. Black, R. E. Leising, J. E. Wilhelm.

Hagesfeld, O. B., Htg. Mgr., American Radiator & Standard Sanitary Corp., Cleveland. References: Harold Bergman, H. R. Canoyer, W. G. Jewett, C. R. Matthews.

Halasz, S. A., Htg. Engr., Ohio Sheet Metal Co., Cleveland. References: R. H. Cutting, R. A. Keller*, R. A. Little*, S. K. Popkins*.

Herbruck, W. M., Pres., Air Cond. Htg. Sales & Svce. Co., Canton. References: A. W. Baum*, A. F. Conrad, Jr., W. E. Eynon, H. L. Hupp.

Ritter, A. J., Mgr., Summer Air Cond., The C. A. Olsen Mfg. Co., Elyria. References: E. R. Downe, C. L. Grandstaff, W. S. Hultz, W. J. Watchler.

Oklahoma

Shipman, J. R., Prof. Htg. & Air Cond. Engr., Oklahoma Natural Gas Co., Tulsa. References: T. E. Krieg, R. E. Pauling, R. F. Shoemaker, R. W. Winget.

Oregon

△Morrison, Robert, Mgr., United Pipe & Supply Co., Inc., Eugene. References: D. W. Chase, L. T. Harrington, W. R. Norte, J. W. Wallace, Jr.

Pennsylvania

Ferioli, L. A., Jr., Estimator, Industrial Insulation, Inc., Pittsburgh. References: Martin Hannah*, Martin Joyce*, E. N. Sanberg, E. W. Stitt*.

Short, E. P., Jr., Reg'l Sales Engr., John J. Nesbitt, Inc., Philadelphia. References: H. B. Hedges, J. W. McElgin, M. J. Murray, K. W. Will.

Vianey, L. R., Research Engr., Gunnison Homes, Inc., Harrisburg. References: A. L. Hesselschwerdt, James Holt, C. M. F. Peterson, G. B. Wilkes.

Weber, Victor, Vice Pres., Research, Robertshaw-Fulton Controls Co., Irwin. References: E. J. Horton*, W. D. Miller*, F. H. Post*, C. W. Robertshaw*.

South Carolina

△Leppard, B. A., Owner, Cons. Engr., Greenville. References: R. E. Mason, R. O. McGary, J. D. Shepard, R. M. Warren, Jr.

Texas

Dorsett, G. G., Vice Pres., Keetch Metal Works, Dallas. References: T. H. Anspacher, Henry Cohn, E. T. Gessell, L. S. Gilbert.

Fincke, E. R., Designer, Langhammer-Rummel Co., San Antonio. References: K. A. J. Monier, G. R. Rhine, L. D. Royer*, A. J. Rummel.

Irby, J. N., Design Engr., Landauer & Shafer, Engrs., Dallas. References: T. H. Anspacher, W. R. Barbeck, E. T. Gessell, L. L. Landauer.

△James, R. P., Br. Mgr., York Corp., San Antonio. References: H. W. Broadwell, L. H. Hornor, Jr., D. E. Locher, L. S. Pawkett.

Maze, R. W., Reg'l Sales Mgr., The Marley Co., Houston. References: H. E. Degler, E. T. Gessell, W. O. Kretzmeier, L. T. Mart.

△Monier, K. A. J., Partner, A. J. Monier & Co., San Antonio. References: L. H. Hornor, Jr., R. P. James, L. S. Pawkett, A. J. Rummel.

Parce, C. W., Pres., Valley Weathermakers, Inc., Harlingen. References: T. N. Inglis, Jr., R. W. Kotzebue, D. E. Locher, J. E. Sampson.

Royer, Martin, Jr. Engr., Halsey & Royer, Engrs., San Antonio. References: Boone Crisp, T. R. Halsey*, K. A. J. Monier, W. H. Peck.

Silber, P. G., Jr., Mech. Engr., Paul G. Silber & Co., Archts. & Engrs., San Antonio. References: T. P. Christman, L. H. Hornor, Jr., G. R. Rhine, M. E. Staley.

Teal, D. G., Tezel & Cotter Air Cond. Co., San Antonio. References: R. P. Cotter, H. E. Gragg*, Ed Parsons*, O. E. Tezel*.

Truett, J. F., Mgr., Htg. Div., Guarantee Electric Co., San Antonio. References: H. J. Faller, L. H. Hornor, Jr., K. A. J. Monier, L. S. Pawkett.

Wright, A. A., Jr., Engr., Oslin Nation Co., Dallas. References: Henry Cohn, D. P. Maley, Jr., H. J. Martyn, Jr., Oslin Nation.

Washington

Dunn, K. G., Maintenance Man, General Electric Co., Richland. References: G. M. Dieter, W. R. Elam, F. W. Jenkinson, Edward Senna.

Massart, G. F., Owner, Grant Co. Plbg. & Htg. Co., Moses Lake. References: H. A. Bickel, H. W. Frederick*, J. L. Harvey, R. D. Nevers.

Nevers, R. D., Sales Mgr., Nelson Mechanical Equipment Co., Spokane. References: J. E. Bowers, L. E. Marque, T. P. Nau, W. C. Vradenburg.

Wisconsin

Degner, A. C., Jr. Plant Engr., Fairbanks, Morse & Co., Beloit. References: J. R. Fellows, C. H. Hillman, Burton Hoger*, D. E. Horock.

Canada

Bristow, H. J., Dist. Mgr., Minneapolis-Honeywell Regulator Co. Ltd., Edmonton, Alta. References: E. K. Cumming, W. T. E. Duncan, J. H. Fox, David Panar.

Earley, C. F., Engrg. Asst., Canadian General Electric Co., Ltd., Vancouver, B.C. References: A. S. Garven*, E. M. Johnson*, R. J. Ker, D. B. Thomas.

Herring, D. P., Coordinating Engr., Polymer Corp., Sarnia, Ont. References: A. M. Clark, W. J. Farago*, J. H. Gregory, N. B. Hutcheon.

Pierce, J. F., Estimator, John Peart & Son, St. Catherines, Ont. References: K. D. Leitch, A. A. J. Liddiard, W. J. Usher, Jr., R. H. Williams*.

Brazil

△Hall, R. S., Pres., R. S. Hall Ltda., Sao Paulo. References: A. H. Bahnson, Jr., Albert Davis, Isaac Serebranik, J. M. van Swaay.

Zauli, Arrigo, Gen. Dir., S. A. Ventiladores Zauli, Sao Paulo. References: H. R. Bodanzky, N. J. Botelho, Mario Lantery, Isaac Serebranik.

England

△Holland, G. M., Sr. Htg. & Vent. Design Engr., Alfred J. Smith, Cons. Engr., London. References: A. J. Chatfield, G. H. Cramp*, P. F. Muggridge*, A. J. Smith.

Finland

Nielsen, L. H., Engr., Valmet Oy, Helsinki. References: F. E. Dunn*, J. M. Rachal*, Americo Silvera, F. B. Wilder.

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Weidner, C. K., Dean, Engrg. Div., American University of Beirut, Beirut. References: Lincoln Bouillon, F. M. Carhart*, P. B. Gordon, J. W. Thompson*.

Mexico

De Palacio, R. C., Owner, Aparatos Indicadores de Nivel para Liquidos, Mexico, D. F. References: L. A. A. Alvarez*, George Gilfrin, Armando Valdes, Carlos Veraza.

In Memoriam

Gustus L. Larson 1881-1953

THE NEWS of the unexpected death Sunday, August 16, of Professor Gustus L. Larson, widely known educator, author and consulting engineer, was received with deep regret by the Society. A past president of ASHVE, Professor Larson was a highly respected authority on heating and air conditioning, his teachings and research studies influencing many. He was 72 years old at the time of his death.

Born in Sweden, Professor Larson came to the United States at the age of nine and was naturalized at 21. He was graduated from the University of Idaho in 1907 with a B.S. in electrical engineering, and was employed by the General Electric Co., Schenectady, N.Y., as a test engineer from 1907 to 1909. In 1909 he returned to Idaho to accept an appointment to teach engineering at the University, and began his long and successful career in the educational field.

As a result of an extensive research investigation of recirculation of washed air in an enclosure, Professor Larson was granted a mechanical engineering degree by the University of Wisconsin in 1915. From 1915 to 1920 he was associate professor of steam and gas engineering at the University, and in 1920 was appointed a full professor and chairman of the Department of Mechanical Engineering.

As a consultant engineer, Professor Larson was instrumental in designing mechanical equipment for many outstanding private and public buildings in Wisconsin and Illinois. Among these were the Wisconsin Power and Light Building, Tenney Office Building, Memorial Union Building, University of Wisconsin Field House, and Manchester's Department Store, all in Madison; Dane County Sanitarium; Central Illinois Public Service Building, Springfield, Ill.; and numerous public schools in the area. He also designed the mechanical equipment of several large hospital units built in Milwaukee, Madison and Janesville.

In 1925 Professor Larson was appointed by the Wisconsin Industrial Commission to assist in drafting Wisconsin's heating and ventilating code, and in 1936 helped to formulate its air conditioning code. During Franklin D. Roosevelt's administration he was called to Washington to serve on the Conference on Home Building and Ownership.

Professor Larson's many contributions to his profession were highlighted in May of 1951, when more than 200 persons gathered in Madison to honor him upon his retirement as Professor of Mechanical Engineering at the University of Wisconsin. Among those who paid tribute at this time were students, former students, faculty colleagues, Society friends, and others who had benefited by knowing Professor Larson. A few weeks earlier, the Wisconsin Chapter of ASHVE had established the Gustus L. Larson Award, to be presented annually to an outstanding University of Wisconsin engineering student. Professor Larson had served for many years on the Board of Governors of the chapter.

Among other engineering societies in which Professor Larson held active membership were: *American Society of Mechanical Engineers, Engineering Society of Wisconsin* of which he was president in 1933, *Society for the Promotion of Engineering Education, American Association of University Professors* and the *National Association of Power Engineers.*

He also was a member of the following honorary and social fraternities: Phi Delta Theta, Triangle, Tau Beta Pi, Sigma Xi and Phi Kappa Phi. From 1926 to 1929 he acted as national president of Pi Tau Sigma, national honorary in mechanical engineering.

His service to the Society, extending over many years, began in 1928 and was climaxed in 1936 when he was elected president of ASHVE. From 1929 to 1936 he was a member of the Council. In 1934 he was elected second Vice President of the Society and in 1935, first Vice President. Among the many committees on which he served actively were the following:

1928 Technical Advisory Committee on Infiltration of Air into Buildings (Chairman)
1929 Council, Committee on Membership
Technical Advisory Committee on Infiltration (Chairman)
1930 Council, Publication Committee (Chairman)
Technical Advisory Committee on Infiltration (Chairman)
Nominating Committee (Chairman)
1931 Council, Committee on Meetings Programs (Chairman)
Technical Advisory Committee on Infiltration (Chairman)
1932 Council, Chairman of Committee on Research
1933 Council, Chairman of Committee on Research
Council, Executive Committee
1934 Second Vice President
Guide Publication Committee
Committee on Research
Research Finance Committee
1935 First Vice President
Guide Publication Committee (Chairman)
F. Paul Anderson Award Committee (Chairman)
1937 Advisory Council (Chairman)
1937-38 F. Paul Anderson Award Committee
1939 Committee on Engineering Scholarships

JOURNAL SECTION

WILLIAM K. GRIGGS
Drexel Hill, Pa.

It was with sorrow that the Society learned of the sudden passing on June 29 of William K. Griggs who suffered a stroke while moving into a new apartment. A member of the Society since 1951, he was employed as a sales manager for Air-A-Therm Co., Philadelphia, Pa.

A direct descendent of Francis Scott Key, Mr. Griggs was born on June 18, 1898 at Bahmo-Burma. He served in the Navy during World War I and then attended the University of Pennsylvania, Philadelphia. His first position in 1919 was as draftsman with the York Corp., Philadelphia, where he rose to chief engineer and remained until 1941. Between 1941-47 Mr. Griggs was associated with the Sun Shipbuilding & Dry Dock Co. as an engineer, specializing in refrigeration and air conditioning. During 1947-52 he was a district sales representative for the General Electric Co. in Philadelphia. He joined the staff of Air-A-Therm in 1952 and was with that firm until the time of his death.

He was also a member of the *American Society of Refrigerating Engineers*, the *Society of Naval Architects and Marine Engineers* and the *American Society of Naval Engineers*.

Mr. Griggs is survived by his wife, Margaret M.; a son, William C.; a daughter, Mrs. John H. Hatfield; his mother, Mrs. Anna L.; a sister, Mrs. Marvin R. Gustufson; and two grandchildren to whom the Officers and Council extend their profound sympathies.

HARRY B. JOYCE
Erie, Pa.

It was with deep regret that the Society learned of the death of Harry B. Joyce, Friday, Aug. 21. He was 64 years old.

Mr. Joyce was born February 25, 1889 in Baltimore, Md. He attended Baltimore Polytechnic Institute for four years, and received his M. E. degree from Cornell University in 1912.

Mr. Joyce originally joined ASHVE in 1922, at which time he was employed as chief engineer for the Centrifugal Fan Co., Newark, N. J. Prior to 1922, he had worked for the United Railroads & Electric Co., the New York Edison Co., the United Electric Light & Power Co., and as a member of the firm of Johnson & Benham, Inc.

In 1929, Mr. Joyce established his own engineering consultant firm, primarily dealing with mechanical and electrical equipment for buildings.

A member of *ASME*, *AIEE* and *F. & A.M.*, Mr. Joyce had also been active on the Pennsylvania State Examining Board for Professional Engineers, the Erie Building Code Commission and Appeals Board. From 1933 to 1935 he served as a district engineer for the state, and in 1941 organized the OPM district office in Erie, operating it until 1944 when he returned to private practice.

CHARLES E. MAYETTE
San Francisco, Calif.

The Society was saddened by the news of the sudden death, June 20, of Charles E. Mayette, who had suffered a heart attack. At the time, Mr. Mayette was chief of the Operations Engineering Section, Housing & Home Finance Agency, Public Housing Administration, San Francisco, Calif.

Mr. Mayette was born on June 20, 1893, in Tewksbury, Mass., and attended high school in Holyoke, Mass. From 1926-28 he studied engineering at the CCNY night school.

Prior to his association with the PHA, Mr. Mayette had served in various capacities, including: mechanical designer, Stone & Webster, Inc.; mechanical designer and engineer, United Engineers & Constructors; principal mechanical engineer, U. S. Housing Authority; assistant chief engineer, E. B. Badger & Sons Co.; chief engineer, Hanley & Co.; chief, field coordination, Kelley Corp.; and chief, Heat & Fuels Unit, and chief, Refrigeration, Air Conditioning and Ventilation, Air Force Dept.

Other societies of which Mr. Mayette was a member included *NDHA* and *ASME*.

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*Member of Committee on Research.

ASHVE — OFFICERS OF CHAPTERS AND BRANCHES

(53 Chapters; 1 Special Branch; 9 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

● **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, Third Tuesday. PRESIDENT, Herman Cumnock, 401 W. Capitol Ave. SECRETARY, W. J. Franklin, 619 Rector Bldg.

● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, Second Monday. PRESIDENT, J. G. Croley, 400 Batavia St., East Point, Ga. SECRETARY, T. A. Barrow, 157 Simpson St., N.W.

● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, Third Wednesday. PRESIDENT, H. D. Glaser, Federal Land Bank Bldg., 2315 St. Paul St. (18). SECRETARY, G. J. Senner, 6010 Edmondson Ave. (28).

● **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. Meets, Second Wednesday. PRESIDENT, C. W. Leek, 1155 West 49th Ave. SECRETARY, D. A. English, 6412 Adera St.

● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, C. R. Acheson, 306 W. Genesee St. SECRETARY, H. K. Ormsby, 205 S. Townsend St. (2).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT, N. T. Hess, 63 E. Goodale St. SECRETARY, R. A. Wilson, 20 S. Third St., (15).

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, R. C. Beineke, 628 Broadway, (2). SECRETARY, A. H. Gerdsen, 224 E. Second St., (2).

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, G. F. Nieske, 165 Maple St., Naugatuck. SECRETARY, E. J. Hoagland, 257 S. Whitney St., Hartford.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, Third Tuesday. PRESIDENT, H. L. Salaun, 317 Baronne St. SECRETARY, T. J. Jenny, 1000 S. Peters St., (9).

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. Meets, Second Wednesday. PRESIDENT, N. W. Burrill, 33 Riverside Ave., Rensselaer. SECRETARY, L. V. Appleby, R.D. 2, Watervliet.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, First Thursday. PRESIDENT, J. E. Murray, 350 Mission St. (5). SECRETARY, D. E. McLeod, 3740 Clay St. (18).

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, Second Monday. PRESIDENT, H. G. Chapin, 185 N. Wabash Ave., (1). SECRETARY, H. G. Gragg, Rm. 1310, 228 N. LaSalle St. (1).

● **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, R. C. Blackman, 5505 N. Illinois St., (8). SECRETARY, J. W. Jackson, 3514 N. Drexel, (18).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, G. M. Dieter, 917 W. Mallon. SECRETARY, F. W. Jenkinson, N. 1904 Smith St., (15).

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, L. F. Sandfort, Iowa State College, Ames. SECRETARY, G. J. Kraai, 907 Sixth Ave. (14).

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tuesday after First Monday. PRESIDENT, R. L. Pennington, 520 So. Commerce (2). SECRETARY, O. B. Strahm, 601 So. Terrace Dr.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, G. H. Stoffer, 200 Riss Building (6). SECRETARY, A. S. Hurt, Jr., 2119 Washington St., (8).

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Third Thursday. PRESIDENT, A. K. Piercy, 222 Osborne St. N. SECRETARY,, D. B. Brace, 1550 Dublin Ave.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, A. L. Hare, 127 Federal St. (10). SECRETARY, W. G. Martin, Jr., 20 Winchester St. (16).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, W. L. Drake, 15 N. Reese. SECRETARY, A. T. Bevil, 1638 Union Ave. (4).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, John Schweiger, 593 Acorn Drive, Dayton (9). SECRETARY, D. E. Tullis, 743 Kiser St. (4).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, R. H. Oberschulte, 316 McKerchey Building, (1). SECRETARY, D. S. Falk, 4864 Woodward Ave. (1).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, V. E. Pearson, 739 Marquette Ave. (2). SECRETARY, E. T. Erickson, 500 Baker Arcade.

● **MISSISSIPPI:** 1953. Hdqrs., Jackson, Miss. PRESIDENT, Burt Lomax, Jr., P. O. Box 1662. SECRETARY, J. G. Coleman, 2840 Arbor Hills Drive.

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, B. J. Horsburgh, 940 Ogilvy Ave. (15). SECRETARY, R. J. Ker, 1000 Beaver Hall Hill, P. O. Box 340.

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, O. J. Smith, 233 Grain Exchange Bldg., (2). SECRETARY, C. A. Failor, 618 So. 31st Ave. (5).

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, J. E. Schechter, 28 Brower Ave., Woodmere, L. I. SECRETARY, Carl H. Flink, 62 Worth St. (13).

● **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, Second Tuesday. PRESIDENT, F. H. Faust, 5 Lawrence St., Bloomfield. SECRETARY, C. H. Smith, 2490 Vreeland Mills Rd., Linden.

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, P. N. Vinther, 929 Mercantile Securities Bldg. SECRETARY, J. A. Ray, 4411 Belmont Ave. (4).

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, Second Tuesday. PRESIDENT, J. N. Watt, 528 E. Fifth. SECRETARY, J. C. Netherton, Jr., 3130 E. 44th St.

● **NORTHERN OHIO:** 1916. Hdqrs. Cleveland, Ohio. Meets, Second Monday. PRESIDENT, J. M. Black, 1296 Gordon Rd., Lyndhurst. SECRETARY, M. L. Erickson, 7218 Euclid Ave., (3).

● **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N.C. Meets, Second or Third Friday. PRESIDENT, J. E. Hart, 1001 E. Bessemer Ave. SECRETARY, S. T. Oliver, 2307 Fairfield Ave.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, W. J. Collins, Jr., 1708 Westminster Pl. SECRETARY, F. X. Loeffler, Jr., 1604 N. W. Fifth St.

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, N. W. Kingsland, 31 Willcocks St. SECRETARY, H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, A. N. Hoss, 621 S.W. Alder (5). SECRETARY, J. E. Finkbeiner, 10260 S.W. Daphne Pl. (1).

● **OTTAWA VALLEY:** 1952. Hdqrs., Ottawa, Ont., Canada. Meets, Third Tuesday. PRESIDENT, Bernard Stotesbury, 955 Somerset St. W. SECRETARY, E. J. Schoenherr, 32 Clarey Ave. (1).

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, W. B. Pride, 3111 Dose Ter. (44). SECRETARY, I. L. Winsor, 20031 Marine View Dr. S.W. (66).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, C. F. Dietz, 3449 W. Indiana Ave. (32). SECRETARY, P. H. Yeomans, Architects Building (3).

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, C. H. Schneider, 310 Washington Rd. SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, H. L. Wray, 1101 Geneva St., Aurora. SECRETARY, J. F. Cipra, Jr., 2676 S. Madison St.

● **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. Meets, First Wednesday. PRESIDENT, E. C. McKinsey, 4220 Annette (21). SECRETARY, R. A. Sarro, 5412 Argo Way.

● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, H. C. Sharp, 4060 W. Pine Blvd. (8). SECRETARY, W. P. Norris, 1118 Fullerton Bldg.

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, M. A. Hudson, 753 Gladstone Blvd. SECRETARY, R. S. Segall, 603 Cotton St.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, E. G. Floeter, Jr., P.O. Box 6006 (6). SECRETARY, F. M. Neil, 3513 W. Dallas Ave. (19).

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, L. B. Davenport, 137 S. Anderson St. (33). SECRETARY, J. L. McCullough, 1978 S. Los Angeles St. (11).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRESIDENT, R. E. Mason, 1726 Hutchinson Ave. (1). SECRETARY, S. B. Blanton, Box 6096.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, D. E. Locher, Box 949, Corpus Christi. SECRETARY, F. B. Frazee, 1013 Riverside Dr., Austin.

● **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, Third Thursday. PRESIDENT, M. L. Gollaher, 1163 Roosevelt Ave. (5). SECRETARY, G. L. Soderborg, Sr., 42 E. 8th St. S.

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, E. D. Duval, 1023 Hanover Ave. SECRETARY, T. B. Carpenter, 412 Chester St.

● **WASHINGTON, D. C.** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, J. G. Muirheid, Bureau of Ships, Navy Dept. (25). SECRETARY, W. C. Reamy, Jr., 17th & Pennsylvania Ave., N. W. (6).

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, J. T. Anderson Michigan State College, East Lansing. SECRETARY, N. A. Buckley, 514 Park Rd., Jackson.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, C. W. Stone, 1219 Main St. (9). SECRETARY, C. W. Kaupp, 271 Delaware Ave.

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, N. E. Hill, 122 N. Hartwell Ave., Waukesha. SECRETARY, K. H. Forlar, 2711 N. 27th St. (10).

SPECIAL BRANCH

● **SWISS:** 1952. Hdqrs., Zurich, Switzerland. PRESIDENT, Leo de Bruyn, Muhlebachstr, 172, Zurich. SECRETARY, Walter Hausler, Erbstrasse 2, Kusnacht, Zurich.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Sydney Narvey, 5-B Vetville, State College Station. SECRETARY, E. A. Travis, Jr., P.O. Box 3332, College Station.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. Address mail to: Prof. R. R. Irwin, Dept. of M. E., Oklahoma A. & M. College.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. E. Bulletsel, 252 Kings Rd. SECRETARY, I. P. Parkhurst, 1354 Harrison.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, N. J. Kirch, 922 Highland Ave., Lafayette. SECRETARY, H. F. Allen, Jr., 629 University St.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, C. E. Beavers, Box 4083. SECRETARY, C. R. Blank, Jr., Box 2021.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, T. J. Feahney, Jr., 18263 Oak Dr. (21). SECRETARY, W. F. Thull, 18313 New Jersey (19).

● **UNIVERSITY OF KANSAS:** 1949. Hdqrs., Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, H. M. Braymer, 1307-C Brackenridge Apts., (3). SECRETARY, A. D. Wilkinson, Jr., 1423-B Brackenridge Apts., (3).

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, D. S. Harper, 737 Sammon Ave. SECRETARY, L. S. Mitchell, 88 Lawrence Crescent.

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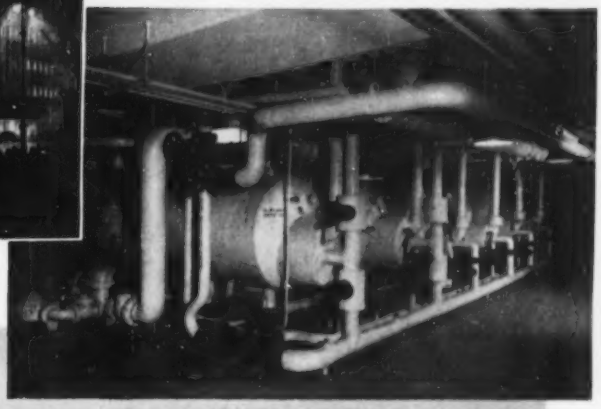
MUTUAL LIFE INSURANCE COMPANY BUILDING

Water Heaters, six of which are shown below; 21 Shower Baths; 7 Dishwashers in the company cafeterias; Photostat Developing Baths for two large photostat machines . . . all are regulated by various types of POWERS Thermostatic devices especially suited for their particular use.

When problems of temperature control arise phone or write POWERS nearest office. With over 60 years' experience and a complete line of controls, some of which are shown below, we can help you find the right solution for your requirements.



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POWERS Thermostatic Water Mixer. Insures utmost comfort and safety in showers. Many other uses.

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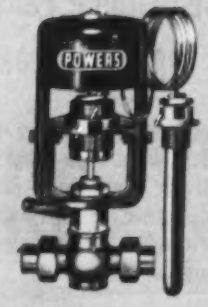

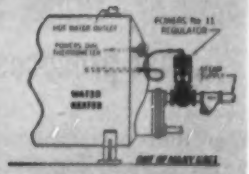

POWERS No. 11 Self-Operating Temperature Regulator for water storage heaters, hot water converters, dishwashers, fuel oil preheaters, jacket water cooling for air compressors, and diesel engines, etc.

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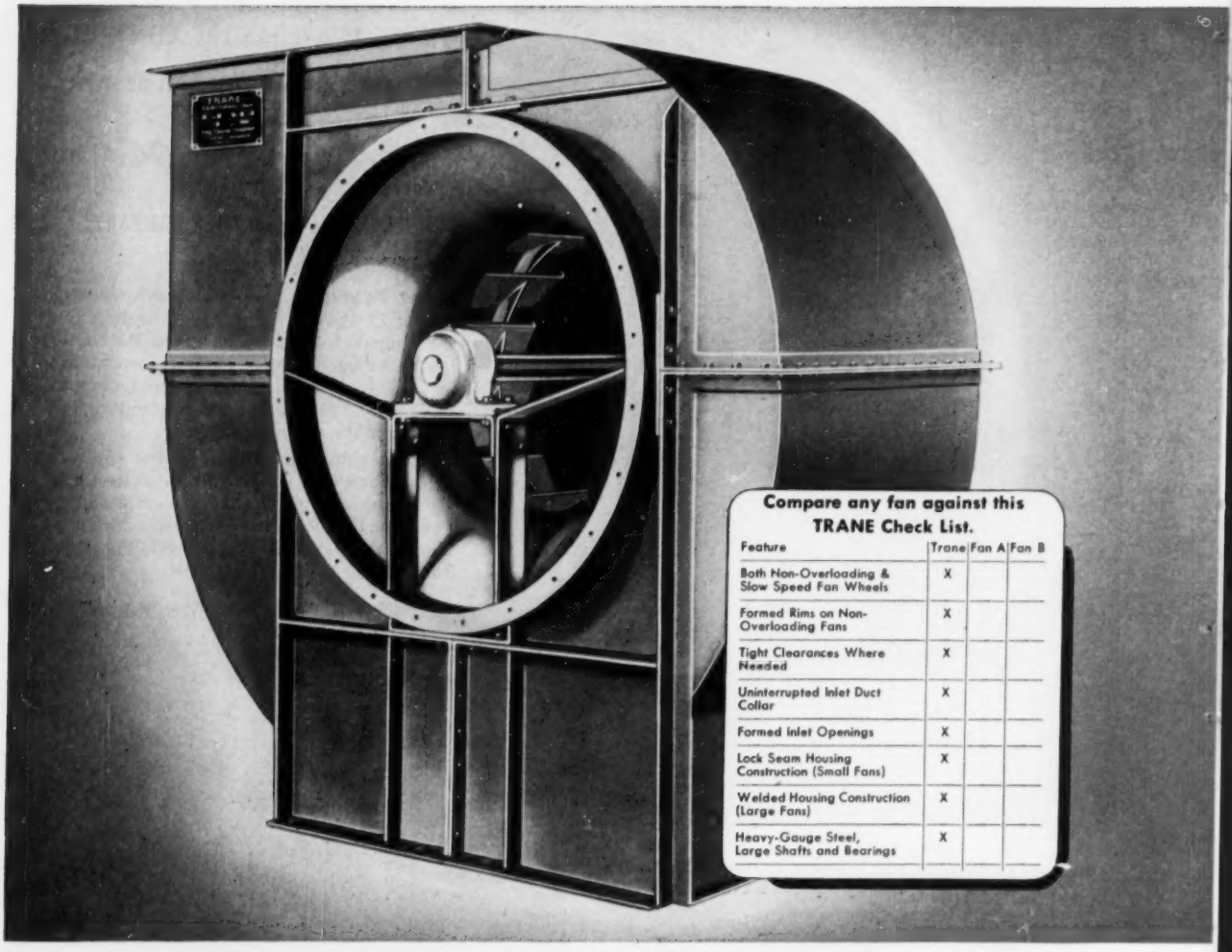
Established in 1891 • **THE POWERS REGULATOR COMPANY** • SKOKIE, ILL. • Offices in Over 50 Cities

Cut power demands with this



Compare any fan against this TRANE Check List.

Feature	Trane	Fan A	Fan B
Both Non-Overloading & Slow Speed Fan Wheels	X		
Formed Rims on Non-Overloading Fans	X		
Tight Clearances Where Needed	X		
Uninterrupted Inlet Duct Collar	X		
Formed Inlet Openings	X		
Lock Seam Housing Construction (Small Fans)	X		
Welded Housing Construction (Large Fans)	X		
Heavy-Gauge Steel, Large Shafts and Bearings	X		

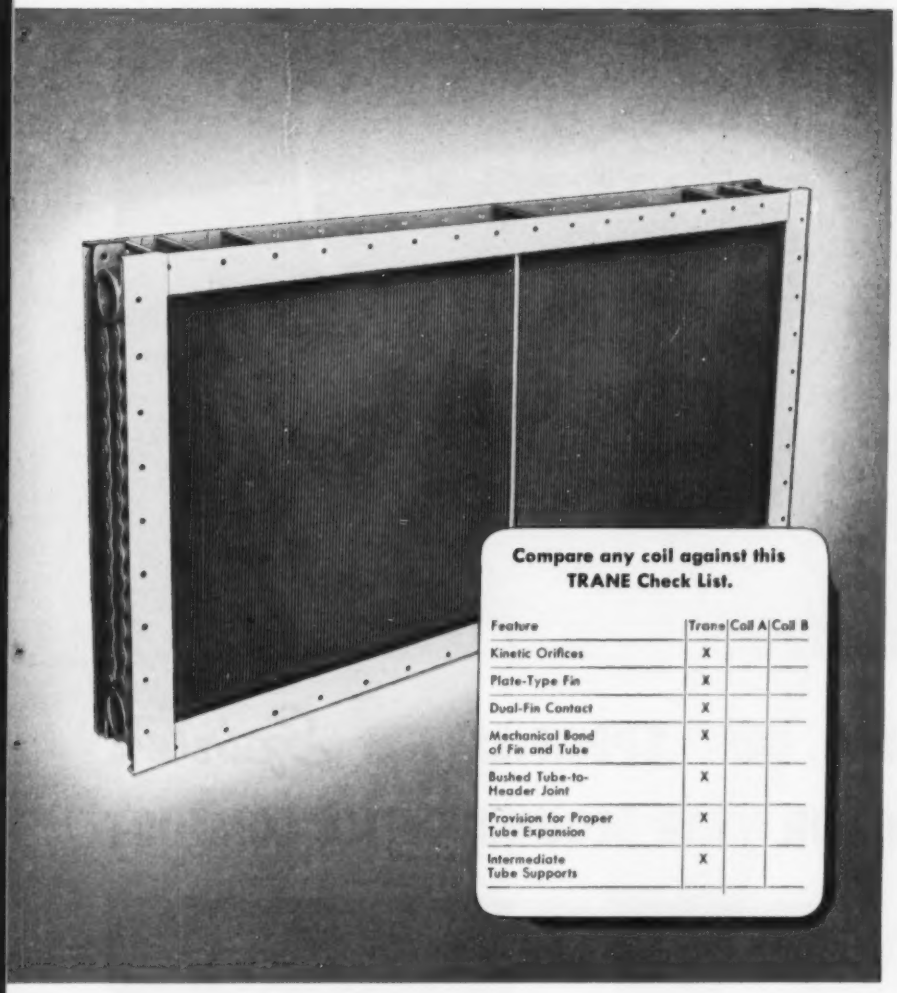
Together, TRANE Centrifugal Fans and TRANE Coils create a central system that produces top performance with less horsepower. Here's why:

Average horsepower requirements of TRANE Fans are unusually low. TRANE Coils, with their plate type fins, offer minimum resistance to air flow. Combine a low horsepower fan with a low air friction coil and power demands shrink accordingly. You get greater efficiency and lower operating costs.

Four of the fifteen reasons why TRANE Fans and Coils give top performance with less horsepower are illustrated on next page. For more complete data, contact your nearest TRANE office or write direct. The TRANE Company, La Crosse, Wis.

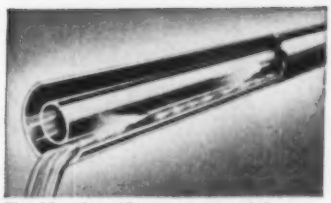
MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING AND VENTILATING EQUIPMENT

Trane combination

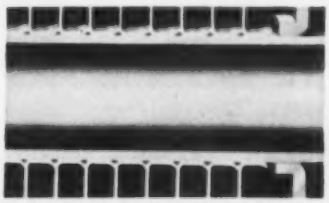


Compare any coil against this TRANE Check List.

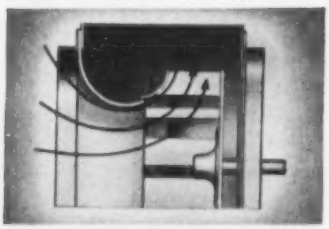
Feature	Trane	Coil A	Coil B
Kinetic Orifices	X		
Plate-Type Fin	X		
Dual-Fin Contact	X		
Mechanical Bond of Fin and Tube	X		
Bushed Tube-to-Header Joint	X		
Provision for Proper Tube Expansion	X		
Intermediate Tube Supports	X		



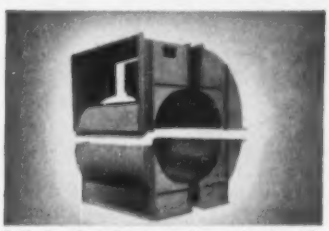
The kinetic orifice, a patented feature of TRANE Type SD Coils, releases steam in the direction of the condensate flow. Drainage of condensate is accelerated. Designed to eliminate temperature stratification and freezing.



Permanent mechanical fin-to-tube bond is as strong as though the fin and tube were one. The wide, flat fin collar produces a generous heat transfer area. Collar of one fin is extended to next fin to form uninterrupted surface for continuous flow of heat.



Accurately streamlined fan inlet cone makes possible even distribution of air in the fan wheel without noisy turbulence. Permits fan to operate at highest efficiency with lowest noise level.



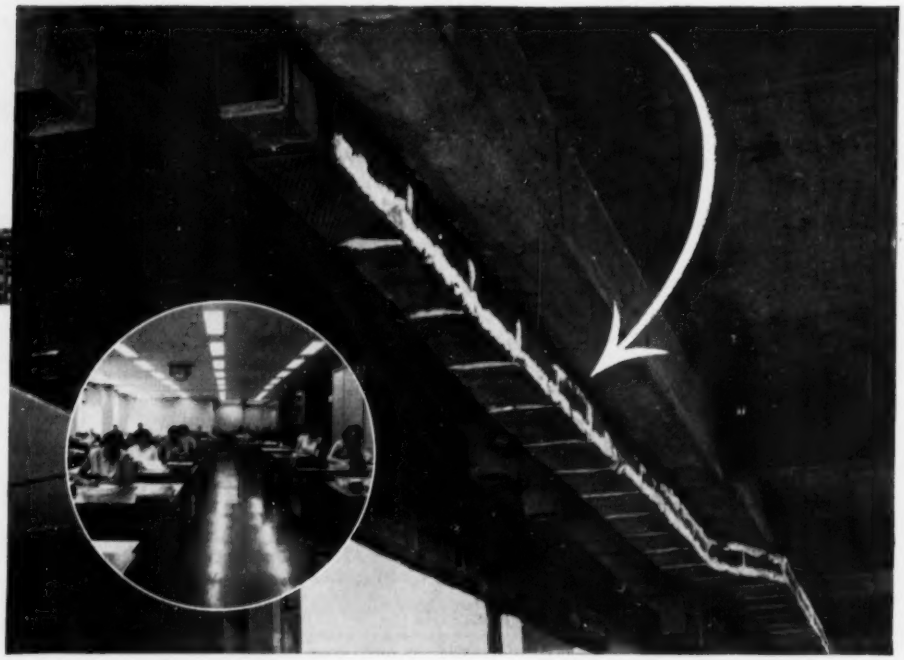
Split fan housing permits easier installation. On large units, housings can be split on horizontal and vertical plane so fan parts can be moved through small openings and reassembled.

Get top performance from less horsepower with

TRANE Fans · Coils

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto • 87 U.S. and 14 Canadian Offices

On air-conditioning ducts serving 420,000 sq ft of office space . . .



Above: New York City's new Chrysler Building East (foreground) and the original Chrysler Building erected some 20 years ago.

Right: Spintex insulation on the air-conditioning ducts serving offices in the Chrysler Building East. Applied by the Asbestos Construction Company, Inc. of New York, an outstanding J-M Insulation Contractor.

CHRYSLER BUILDING EAST SPECIFIES J-M *Spintex* DUCT INSULATION FOR YEAR 'ROUND OFFICE COMFORT

Running through the 32 stories of the new companion structure to the original Chrysler Building are miles of air-conditioning ducts . . . all insulated with Johns-Manville Spintex.

Spintex was chosen because it helps assure the greatest office comfort at the lowest operating cost. It has low thermal conductivity . . . plus resistance to moisture, fire, rot and mold growth. It is one of the most effective insulations for guarding against heat transfer and moisture accumulation.

Johns-Manville flexible, semi-rigid and rigid insulations for air-conditioning ducts meet every industrial requirement. Basically mineral products, each type has its particular characteristics that make it specially suitable for a specific air-conditioning service. All have the low heat transfer properties that are needed for high insulating efficiency.

Proper engineering and application are essential to the peak performance of any insulation. J-M Insulation Engineers and J-M Insulation Contractors stand ready to give you a top quality insulation job that will more than pay off your initial investment with maximum fuel savings.

For further information, write for a copy of Brochure IN-135A. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ont.

J-M insulation applicators applying Spintex on an air-conditioning duct. Thoroughly familiar with J-M insulating materials and application methods, these men have the skill that assures maximum dividends in greater fuel and power savings over the years.

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Kritzer entered the heat transfer field in 1912 and this long experience is reflected in the ability of Kritzer Radiant Coils to heat anything, anywhere—yet remain economical, easier to install, more efficient in use, and absolutely true to their ratings. This last is backed by Kritzer's exclusive CERTIFIED RATINGS—ratings based on and proven by actual operation in the laboratory and the field.

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Spartanburg schools are proud of their Will-Burt Stokers

SPARTANBURG CITY SCHOOLS
SPARTANBURG, S. C.

ANN E. BULL
SECRETARY

J. G. McCRACKEN
SUPERINTENDENT

October 30, 1952

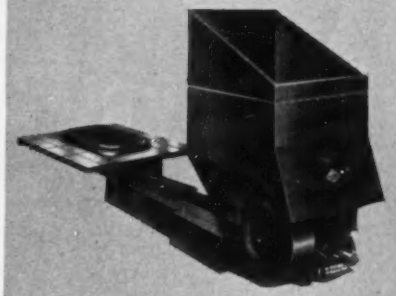
Will-Burt Stoker Company
Orrville, Ohio

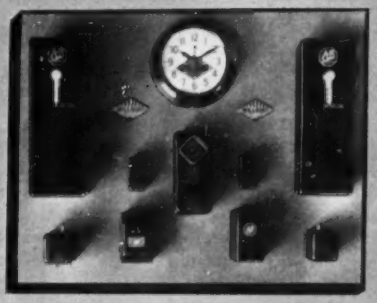
Gentlemen:

We would like to take this opportunity to tell you how pleased we are with our Will-Burt equipment. During the past summer we remodeled our boiler room at the Spartanburg High School and installed two of your 600# Hopper Type Dead Plate stokers. Also, installed was your #PB2K Will-Burt stoker control panel board inter connected for the operation of two Will-Burt stokers. We are very proud of this installation and would recommend Will-Burt to anyone interested in stoker equipment.

Sincerely yours,
J. G. McCracken
J. G. McCracken
Superintendent

JGMc:B





This installation was designed by J. C. Harrison, Consulting Engineer, Spartanburg, S. C. The equipment was sold through Montgomery and Crawford, Inc. and installed by the A. D. Carter Company, both of Spartanburg.

Write today for the details on the complete Will-Burt line of bin-feed and hopper model stokers and the new Will-Burt stoker control panel. If you want to specify and sell the most efficient, most reliable coal heating installations, you need to know about Will-Burt.

WILL-BURT

THE WILL-BURT COMPANY

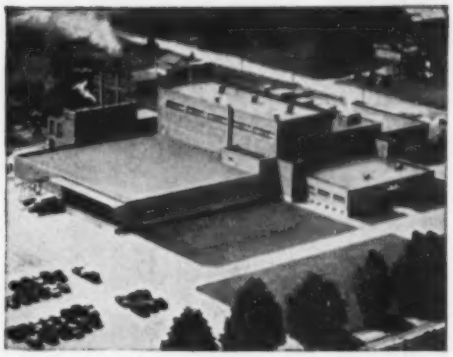
BOX 902 ORRVILLE, OHIO

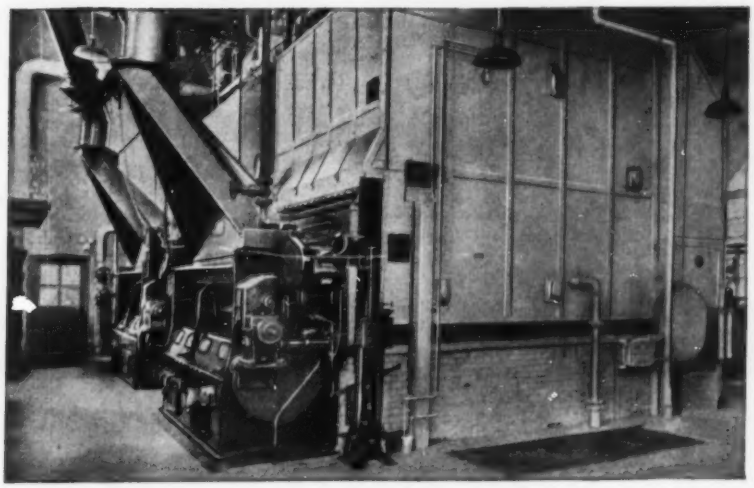
STOKERS • RESIDENTIAL BOILERS • OIL AND GAS CONVERSION BURNERS

"COAL'S BEST FOR OUR MODERN PLANT!

It's low in cost . . . It's clean and convenient!"

says G. W. Peters, Engineering Manager
M&R DIETETIC LABORATORIES, INC.
makers of PREAM & SIMILAC





"We made a careful study of fuels and burning equipment before building our modern new plant in Sturgis, Michigan. This plant was designed to produce baby food. So the steam plant has to be clean and dust-free as well as economical to operate. Also, we wanted a fuel we could store safely and easily in order to insure ourselves against any shortages.

"We decided on bituminous coal—and the up-to-date installation shown here. It certainly fills the bill on every count. Our modern combustion equipment makes coal far more economical than any other fuel. Up-to-date coal and ash handling give us convenient operation completely free of dust nuisance."

Additional case histories, showing how other types of plants have saved money by burning coal the modern way, are available upon request.

Discover for yourself the great advantages of coal burned the modern way. Call in a consulting engineer. He'll show you how today's combustion equipment can give you 10% to 40% more power from a ton of bituminous coal than from equipment used only a few years ago. He'll show you how modern labor-saving coal and ash-handling equipment make a coal-fired installation clean, convenient, and dust-free.

If you plan to remodel or build a new plant, be sure to look into the low cost and convenience of bituminous coal. Consider coal's other advantages, too. It has reserves that are virtually inexhaustible. America's bituminous coal mining industry is the most efficient and productive in the world. With bituminous coal, you can be sure of plenty of fuel at relatively stable prices now and for years to come.

If you operate a steam plant, you can't afford to ignore these facts!

BITUMINOUS COAL in most places is today's lowest-cost fuel, and coal reserves in America are adequate for *hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

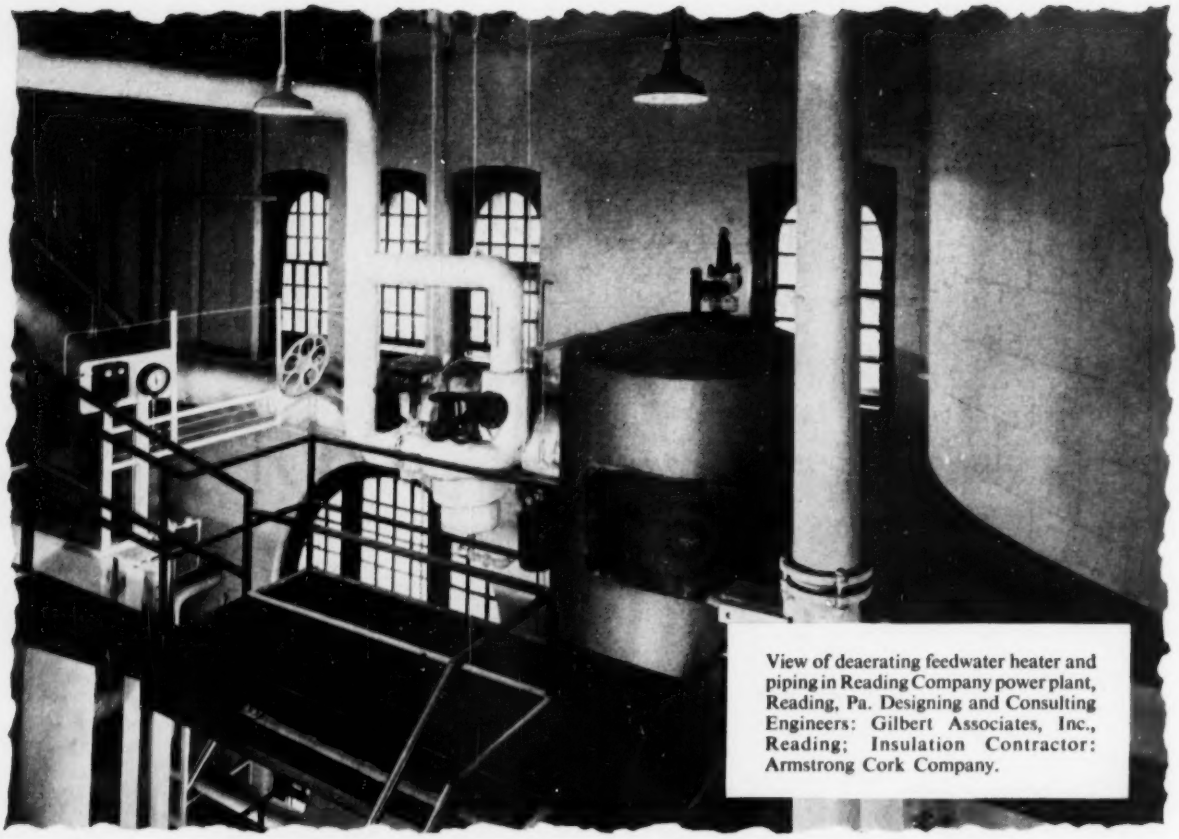
COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association, Southern Building, Washington 5, D.C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!



View of deaerating feedwater heater and piping in Reading Company power plant, Reading, Pa. Designing and Consulting Engineers: Gilbert Associates, Inc., Reading; Insulation Contractor: Armstrong Cork Company.

"Featherweight" 85% MAGNESIA

USED IN MODERNIZATION OF READING COMPANY POWER PLANT

When the Reading Railroad recently modernized its repair shop power plant, "Featherweight" 85% Magnesia was extensively used. The illustration above shows some of the piping and feedwater heater which was covered with this dependable insulation.

For insulating piping and equipment with temperatures up to 600°F., "Featherweight" 85% Magnesia is unexcelled. It acts as an efficient insulator for a lifetime, too—unaffected by vermin, moisture, vibration, or temperature change. It is made in various shapes and thicknesses for easy application over any equipment or piping.

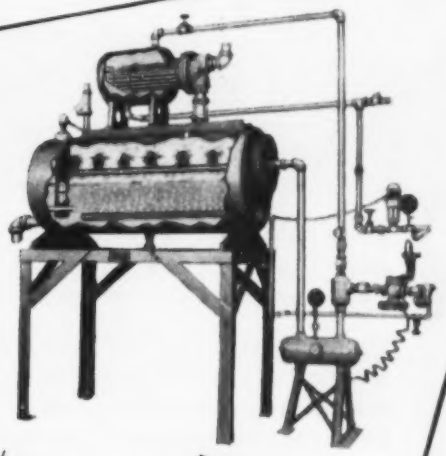
The K&M distributor in your area is an experienced applicator who will gladly tell you more about "Featherweight" 85% Magnesia. Call him today! Or, write directly to us for information.

Nature made asbestos...
Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY · AMBLER · PENNSYLVANIA

A FRESH LOOK INTO *Deaeration!*

SCHAUB ZERO-OXYGEN *Deaerators*



ENTIRELY NEW

in operating principle

in mechanical design

In the advantages they offer

"Newness" for its own sake is no advantage in a deaerator. But when new thinking achieves improved performance not possible with conventional designs, it's worth looking into!

The Schaub Zero-Oxygen Deaerator differs from all others in that it provides *external* pre-heating to a temperature *above* boiling point, with over-atmospheric pressure held only up to the internal sprayer manifold. The storage receiver itself is *fully vented* and operates at constant, safe atmospheric pressure.

This simple but basic difference opens the way to a whole series of better performance characteristics, including:

LOW OPERATING COSTS
LOW MAINTENANCE COSTS
COMPLETE OXYGEN REMOVAL—(to .005 cc/liter)
COMPLETE SAFETY
WIDE RANGE FOR LOAD VARIATIONS
SIMPLER DESIGN AND OPERATION

The "hows" and "whys" of Schaub Zero-Oxygen Deaerators make an important story for any engineer or operating man concerned with boiler feedwater deaeration. Mail the coupon and we'll send it to you.

FRED H. SCHAUB ENGINEERING COMPANY
2116 South Marshall Boulevard • Chicago 23, Illinois

MAIL THE COUPON FOR BULLETIN 575

Why a deaerating system? How can it save you money and trouble? What makes a good system? How to get maximum benefits at lowest cost? What are some of the engineering factors involved?

These and many other questions are answered in Schaub Bulletin 575, just off the press. It's a valuable contribution to boiler deaeration theory and practice.

FRED H. SCHAUB ENGINEERING COMPANY
2116 South Marshall Boulevard Chicago 23, Illinois

Please send me, without cost or obligation, my personal copy of your new Bulletin 575 on Boiler Feedwater Deaeration.

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COMPANY.....

ADDRESS.....

CITY..... ZONE.... STATE.....

5 of many REASONS WHY—

CHRYSLER AIRTEMP "PACKAGED" AIR CONDITIONERS ARE THE BEST YOU CAN SELL TODAY...

★ Sealed radial compressor, pioneered by Chrysler Airtemp over 16 years ago, is so dependable, it's now backed by a 5-year warranty, which you can pass on to your customers.

★ More quiet operation—the radial compressor design reduces vibration to a minimum. Vibration and noise are further reduced by flexible connections in the suction and discharge lines and rubber compressor suspension.

★ Exclusive "Maxi-Fin" Cooling Coil increases cooling surfaces for greater efficiency.

★ "Airfoil" Grille with individually adjustable vanes to direct cooled air wherever wanted.

★ "Bonderite" anchors the paint to the metal—resists corrosion—fortifies finish around accidental breaks.

There are more reasons, too, why it will pay you to sell the "Packaged" Air Conditioning most people buy—Chrysler Airtemp! Send coupon today for all of the facts.

Comfort Zone FOR PROFIT

Chrysler Airtemp

HEATING • AIR CONDITIONING FOR HOME, BUSINESS, INDUSTRY

AIRTEMP DIVISION OF CHRYSLER CORPORATION
DAYTON 1, OHIO

AIR COOLED
"Packaged" Air Conditioner

WATER COOLED
"Packaged" Air Conditioner

Airtemp Division of Chrysler Corporation HP&AC—10-53
P.O. Box 1037, Dayton 1, Ohio

I would like to know more about the Chrysler Airtemp proposition.

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Guaranteed by Good Housekeeping

SPANG
SPANG CW
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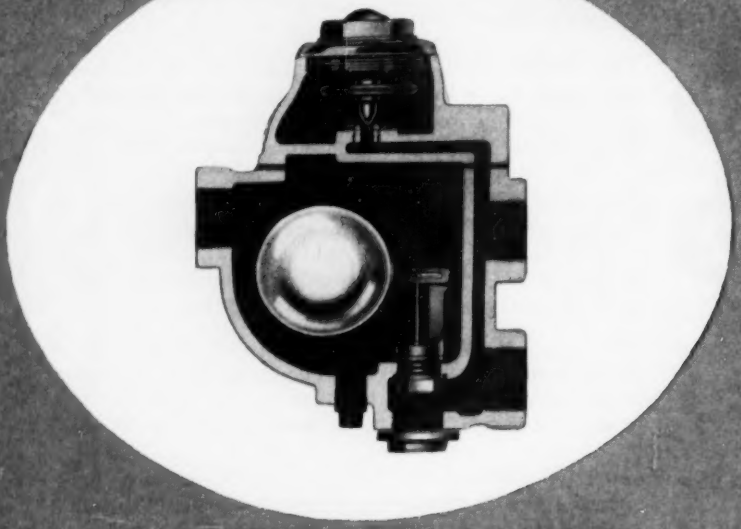
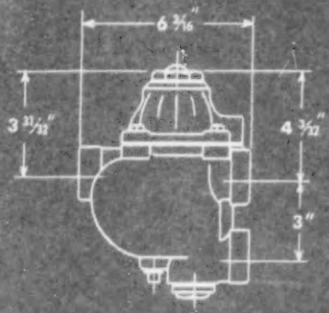
Top Grade Steel—Spang's steel requirements call for steel skelp made to rigid metallurgical and physical specifications, giving it inherent qualities that contribute to easy bending and threading of the finished pipe.
Quality-Controlled Processing—Automatic controls governing the three heat zones under predetermined conditions permit heating the skelp gradually and progressively to the correct welding temperature. The skelp is kept free of dirt and foreign matter.
Strong, Clean, Uniform Welds—Quality controlled heating to the right temperature assures highest quality welds and strength in the finished pipe. Skelp is air-blasted to remove loose scale prior to welding.
Smooth, Clean Finish—Spang CW is de-scaled inside and outside, producing a clean and neat-appearing surface and providing closer bonding and longer life for galvanized coatings.
Uniform Diameter—Careful sizing and straightening of quality-controlled Spang CW Pipe gives it a uniform diameter which makes it easier to thread, bend and fabricate on the job or in the shop.
Complete Inspection and Testing—Each length of Spang CW Pipe is inspected inside and outside; threads are checked for pitch, length and quality. Spang CW is pressure-tested and hydro-static-tested above actual required working pressures to check weld strength and pipe durability.
It's reasons like these that make Spang CW Steel Pipe the first choice of owners, architects, engineers and contractors who want the best in heating, plumbing and air conditioning systems. They know that Spang CW pays off in extra reliability, faster installations and lower costs.
You can profit, too, by specifying Spang CW Steel Pipe at your local Spang distributor.
SPANG
SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY
General Sales Office: Pittsburgh 30, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis.

MARSH No. 12

Float and Thermostatic Trap



Marsh No. 12, for 0-15 psi, and No. 512, for 15-125 psi, are available in either ½" or 1" pipe size. Note two optional outlet openings.



. . . The most dependable trap you can use

There are many jobs that only a float *and* thermostatic trap can handle properly . . . and in the Marsh No. 12 you have the most respected F & T trap ever developed.

Here is a trap that counts its users in thousands. Repeat orders are the rule because men who know have discovered that no other trap can quite duplicate its absolutely dependable, trouble-free performance in removing all air and condensate from steam mains, branches, risers, unit heaters, coils, and similar applications.

Two precision-built assemblies accomplish this. All condensation is discharged by the float-operated valve located at the low point in the trap body. All air is vented through the by-pass by the action of the thermostatic diaphragm, but this is one of those Marsh diaphragms that closes the valve immediately in the presence of steam. In fact the accuracy of response is the attribute that distinguishes the Marsh thermostatic element. It gets the air out and keeps the steam *in!* Another big feature is the straight through design which eliminates troublesome excess piping.

No. 12 is your F & T trap for those low pressure applications — up to 15 psi W.S.P. but its identical-in-operation companion, No. 512, covers the working pressure range of 15 to 125 psi. There is a Marsh trap for every low or medium pressure application.

Write for catalog 76-H covering Marsh heating specialties

MARSH HEATING EQUIPMENT CO., *Sales Affiliate of Jas. P. Marsh Corporation*
Dept. T, Skokie, Illinois
Manufacturers of gauges, thermostatic regulating valves, Solenoid valves, heating specialties

MARSH *Heating Specialties* **SINCE 1865**

Here's PROOF *of Acme acceptance throughout the refrigeration industry*

For over thirty years ACME has been producing air conditioning and refrigeration products preferred by original equipment manufacturers of commercial and industrial refrigeration and air conditioning equipment.

ACME's background as heat transfer specialists means dependable, highly efficient fluid chillers, freon and ammonia condensers, oil separators, heat exchangers, liquid receivers, evaporative condensers, cooling towers, and allied products for original equipment manufacturers and general distribution.

Products of the outstanding manufacturers whose trademark appears on this page depend on ACME to maintain their high standards by using components from the complete Acme line.

These Original Equipment Manufacturers . . .

WORTHINGTON

Carrier

GENERAL ELECTRIC

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Lehigh BLU-COLD

bryant

Chrysler Airtemp

Curtis REFRIGERATION AIR CONDITIONING COMMERCIAL

TRANE

MILLS INDUSTRIES, Incorporated

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Voqt FOR BETTER REFRIGERATION

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Baker AIR CONDITIONING and REFRIGERATION

BRUNNER

Select component parts from this COMPLETE *Acme* LINE

DRY-EX* WATER CHILLERS
More than 700 combinations from which to choose, assuring you of the most efficient chiller operation obtainable. Capacities from 5 to 260 tons for all common liquid chilling applications.

ACME CONDENSERS
More than 120 models and standard sizes of Freon and Ammonia shell and tube, and shell and coil types. Capacities from ½ to 700 tons.

BLO-COLD* INDUSTRIAL UNIT COOLERS
For vegetable storage, packing plants and low temperature installations. 5 distinct series for either Freon or Ammonia with more than 260 combinations.

ACME COOLING TOWERS
Available for use where compactness counts. An all metal tower completely galvanized for long life. Capacities from 3 to 60 tons.

ACME OIL SEPARATORS
A complete line of Freon or Ammonia separators for ¼ to 100 ton systems.

ACME HEAT EXCHANGERS
Compact, efficient Freon suction and liquid line heat exchangers designed for systems from 3 to 200 tons.

ACME LIQUID RECEIVERS
More than 70 standard sizes for Freon, Ammonia, or other refrigerants.

HI-PEAK* WATER COOLERS
Seven standard sizes providing large storage capacity and all non-ferrous surfaces in contact with the fluid.

ACME EVAPORATIVE CONDENSERS
For Freon or Ammonia. More than 30 models with capacities up to 1,250,000 BTU/hr. from which to choose. Your choice of either copper tubing or pipe coils. Completely hot-dipped galvanized after fabrication. Capacities from 4 to 130 tons.

FLOW-COLD* PACKAGED LIQUID CHILLERS
A factory assembled, pre-tested liquid chilling unit shipped ready for instant installation. Balanced performance from matched Acme components for systems of 2 to 15 tons. Also used as a Heat Pump providing both heating and cooling for year-round air conditioning.

FLOW-TEMP* REMOTE ROOM CONDITIONERS
Designed for the modern recirculated hot or cold water air conditioning systems. Whisper quiet with variable air recirculation permits efficient individual zone control.

*Trade Mark

ACME INDUSTRIES, INC.

Continuously Serving the Air Conditioning and Refrigeration Industry since 1919

ACME

JACKSON, MICHIGAN

George Teapole Crosscuts Corrugated Aluminum with a Model 825 SKIL Saw and a friction blade. "You can *see* the cut with a SKIL Saw," he says, "a *must* for accuracy!"

"Cuts anything, gives greatest accuracy. We use SKIL Saws exclusively!"

says **E. J. Griser,** foreman, **Elwin G. Smith & Company,** Emsworth, Pittsburgh, Pa.—Specialists in roofing and siding fabrication for commercial and industrial buildings.

Cutting metal or other special materials? Then read about this firm that cuts aluminum, asbestos, cement products, transparent plastics, plastic skylight material and galvanized sheet metal, using SKIL Saws and SKIL special purpose blades—exclusively.

"We've had such great success with SKIL Saws that we've standardized on this famous make," says Foreman Griser. "We now have 100 SKIL Saws in constant use in the shop and in the field.

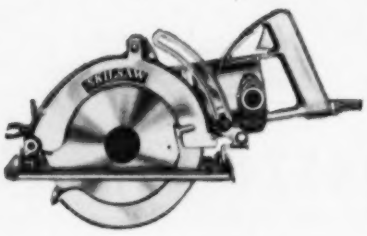
"Their fine precision cutting and durability for continuous rough use on such materials as corrugated aluminum and galvanized sheet steel are outstanding. No matter what your cutting problem, there's a SKIL Saw and blade to do it!"

Ask About the *Complete* Line of SKIL Saw Blades—Standard and Special Purpose

For Complete Information See Your SKIL Distributor or Call Your Nearby SKIL Factory Branch

SKIL
PORTABLE TOOLS

Made only by SKIL Corporation
formerly SKILSAW, Inc.
5033 Elston Avenue, Chicago 30, Illinois
3601 Dundas Street West, Toronto 9, Ontario
Factory Branches in All Leading Cities



Ralph Wise, Superintendent, Uses a Model 825 SKIL Saw for on-the-job cutting. He emphasizes, "This saw lets us trim odd pieces with accuracy. This corrugated material is usually hard to cut because of its uneven surface. Here, I get a smooth, accurate cut. And SKIL's compactness and power give me the cut in least time."

Model 825 SKIL Saw—Powerful, heavy-duty. Ideal where constant use is required. With special SKIL blades, cuts ½" aluminum, copper and lead sheets, other metals, stone and composition. Capacity in wood: 2⅜". Blade speed, 3000 r.p.m.; 850 r.p.m. available at extra cost. Depth and bevel adjustments. Ball bearings throughout.

The most convincing stamp of user satisfaction

ANOTHER REPEAT ORDER FOR SARCO

Lederle's new office building at Pearl River, N. Y. will house over 700 people, is equipped with Sarco heating specialties. Architects: Eggers and Higgins. Consulting Engineers: Jaros, Baum and Bolles. Heating Contractors: Harry Hoyle Contracting Co.

18 years of repeat orders *and now again . . .*

Lederle Laboratories Division American Cyanamid Co. Installs Sarco Heating Specialties

There's a good reason why Sarco Heating Specialties have been specified and used by Lederle again and again.

That reason is Sarco dependability.

Leading architects, engineers and contractors know from the long record of repeated user approval that they can depend on Sarco performance.

The Sarco heating specialties now operating in this new office building and other Lederle Laboratories buildings have been installed over a period of 18 years. Several thousand Sarco steam traps, radiator valves and traps, air eliminators, strainers, and temperature controls are giving satisfactory performance.

For dependable heating specialties and all around satisfaction, you can confidently specify Sarco.

On your request, we'd be happy to send you full information on Sarco's complete line.

FOUR REASONS WHY IT PAYS TO SPECIFY SARCO

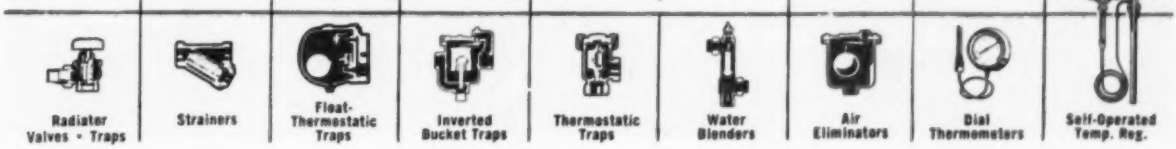
1. Proven Dependability
2. Trouble-free Service
3. Complete Line from One Reliable Manufacturer
4. Nationally Known and Preferred by Users.

SARCO SAVES STEAM

SARCO COMPANY, INC., Empire State Building, New York 1, N. Y.

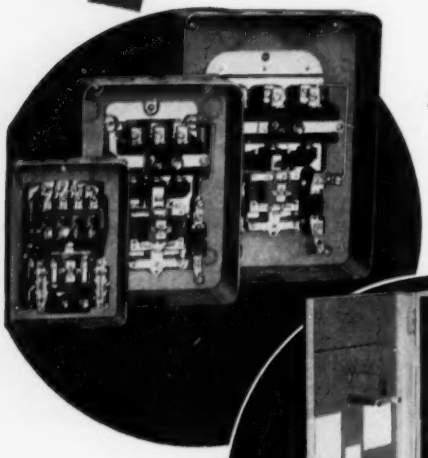
Sarco Canada, Ltd., Toronto 8, Ontario . . . Represented in Principal Cities

STEAM TRAPS • TEMPERATURE CONTROLS • HEATING SPECIALTIES

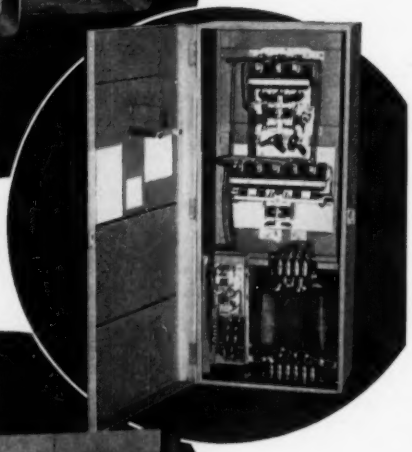


Radiator Valves • Traps | Strainers | Float-Thermostatic Traps | Inverted Bucket Traps | Thermostatic Traps | Water Blenders | Air Eliminators | Dial Thermometers | Self-Operated Temp. Reg.

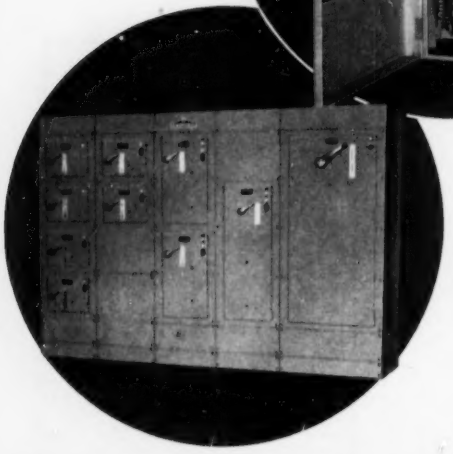
Here's a sound starting point for air conditioning, industrial heating, and refrigeration sales



Across-the-line starters



Reduced voltage starters



Multitrol control centers

In the long run, leading users of motor starting equipment have found it highly profitable to specify motor controls made by Ward Leonard.

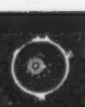
Why? Because installation of Ward Leonard starters is easy, performance is trouble-free, operating life is exceptionally long and maintenance is simplified.

Ward Leonard manufactures a complete line of dependable motor starters for refrigeration, air conditioning and industrial heating applications. Here are the five distinct types of Ward Leonard starters:

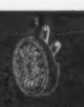
Bulletin 4110 – a-c across-the-line magnetic – non-reversing, 200 hp max.
Bulletin 4170 – a-c Primary resistance, 200 hp max.
Bulletin 4190 – a-c Autotransformer, 200 hp max.
Bulletin 4340 – a-c Part Winding, 400 hp max.
Bulletin 4410 – Multitrol control centers NEMA size five, 600 v. max.

For full particulars on these and other motor controls, send for your copy of Ward Leonard's Motor Control Catalog. Ward Leonard Electric Co., 24 South St., Mount Vernon, N. Y.

WARD LEONARD ELECTRIC COMPANY
MOUNT VERNON, NEW YORK


RHEOSTATS

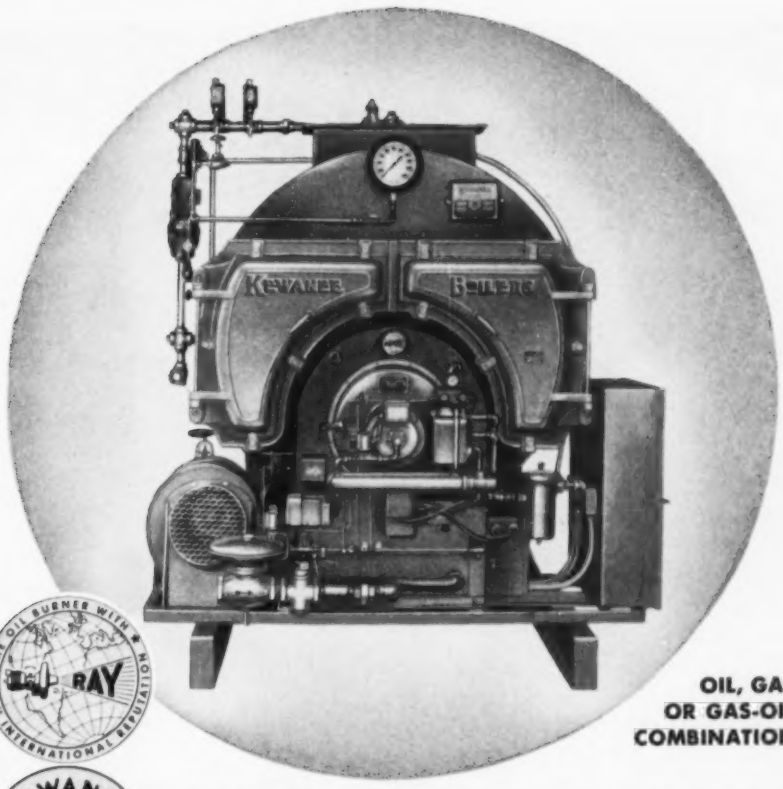
RELAYS


RESISTORS

CHROMASTER

Result-Engineered Controls Since 1892

Ward Leonard's complete engineering text book, "Handbook of Power Resistors," $3. per copy.



OIL, GAS
OR GAS-OIL
COMBINATION

A real advance in steam generation

KEWANEE-RAY
BOILER-BURNER UNIT

Produce steam more economically, more efficiently, with the new Kewanee-Ray Boiler-Burner Unit. Use heavy catalytic residual fuel oils or light oils in combination with high or low pressure gas in a single unit!

New multi-stage, forced draft, secondary air control on the burner provides a constant velocity air stream to the combustion zone. Resulting high turbulence, high turndown ratio and high CO_2 content give you high combustion efficiency.

Quickly Installed . . . Simple to Operate. Matching connections are provided so that when the boiler and burner are brought together they can be easily connected with a minimum of field effort. A flip of the switch and the unit goes to work on either oil or gas. To change fuels, flip the switch again. *That's all.* Fully automatic operation throughout.

The Kewanee-Ray Boiler-Burner Unit is *complete.* Boiler, burner, all automatic controls and accessories as specified. No special foundation is required. All refractories are integrally mounted at the factory. And a built-in forced-draft fan eliminates need for high stacks.

For High or Low Pressure Steam or Hot Water Heating. High pressure units, for 1350 to 15,800 lbs. of steam per hour developing 39 to 456 horsepower at 125 and 150 psi. Low pressure units for 15 lb. steam or 30 lb. water rated at 1,313,000 to 15,300,000 btu.

The complete boiler is shipped from Kewanee, the burner including windbox and control panel from Ray...so each shipment can be timed to arrive when you want it. The boiler should be on the job site before the new plant walls are up. (Exposure to weather does no harm). The shipment of the burner can be delayed until the new building is enclosed. Arrival of unit in two separate shipments is another important advantage when Kewanee-Ray is specified.

RAY OIL BURNER COMPANY 1307 San Jose Avenue, San Francisco, California

KEWANEE-ROSS CORPORATION 108 Franklin Street, Kewanee, Illinois

Please send me your 16-page KR-1031 Catalog giving complete description and specifications on your Boiler-Burner Unit.

NAME_____

ADDRESS_____

CITY_____ STATE_____

Where the Flow Must Be Controlled...

• There is no better type of valve than the R-P&C Bar Stock. It's a fine throttling valve that positively controls flow. It's a sturdy, long-lasting valve made from solid bars of metal.

Male and female end type is made of carbon or chrome stainless in ¼" and ½" sizes, in globe and angle types. Others are made of bronze, stainless, or carbon and stainless in sizes ⅛" to 1". High temperature and pressure ranges.

R-P&C VALVES INCLUDE

- Bronze
- Iron
- Cast Steel
- Forged Steel
- Bar Stock

See your R-P&C distributor today or write our Reading, Pennsylvania office for information

R-P&C valves

ACCO

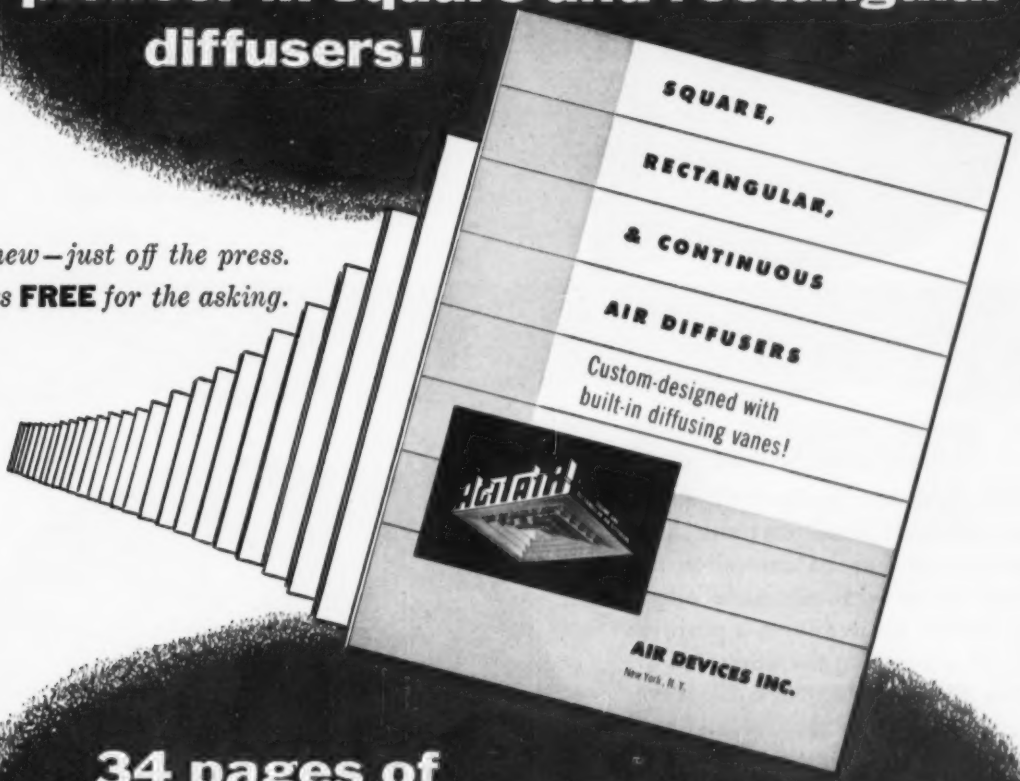
TRADE MARK

R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

Now... correct air distribution simplified by AGITAIR— pioneer in square and rectangular diffusers!

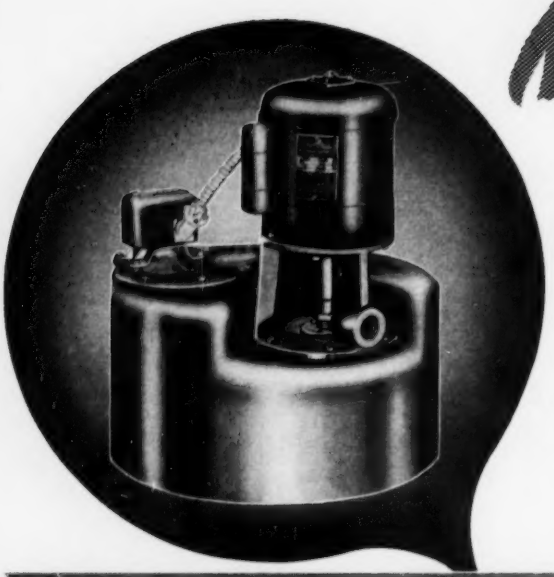
It's new—just off the press.
Yours **FREE** *for the asking.*



34 pages of useful information which you can use with complete confidence.

Contact your local **AGITAIR** *representative or write direct to*

AIR DEVICES INC.
17 East 42nd Street, New York 17, New York
AIR DIFFUSERS • FILTERS • EXHAUSTERS



Now Ready.!

The New Skidmore Duplex Unit offers increased heating pump efficiency. Compact and self-contained — the "CV" Duplex Unit has all the outstanding features of the Skidmore "CV" Single Unit plus extra heavy-duty performance when conditions warrant.

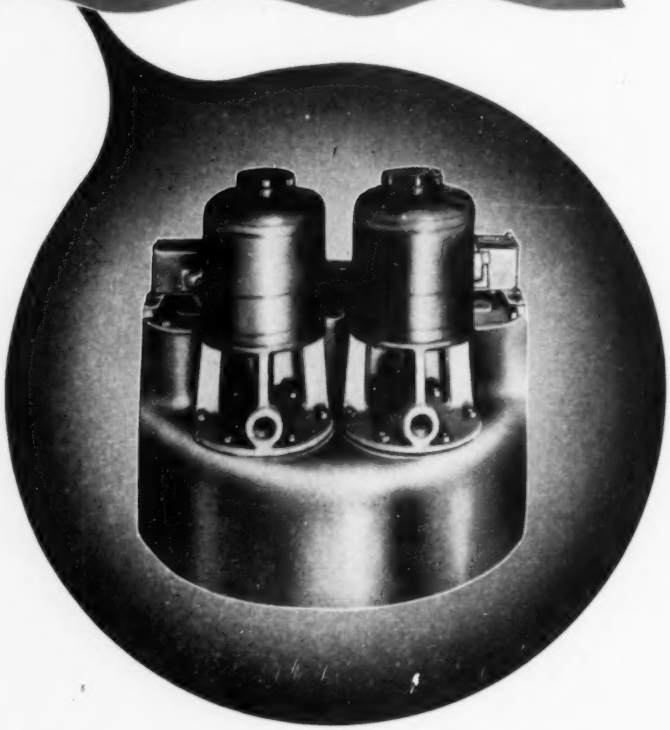
LEFT — SINGLE UNIT

BELOW — DUPLEX UNIT

The NEW "CV" Duplex Unit!

The New Skidmore Duplex Unit is furnished with individual float switches, so each pump may be controlled independently or with automatic alternating switch, which affords a positive means of alternating the operation of the two pumps in turn insuring even wear. The second pump automatically starting into operation when one pump cannot handle the load under peak conditions. Pump is completely assembled ready for return and discharge connections — can be installed on floor level or in pit — float switch is on top for convenient operation.

NOW READY—New Bulletin No. 21-A gives complete engineering data on both the Vertical "CV" Single and Duplex Units.



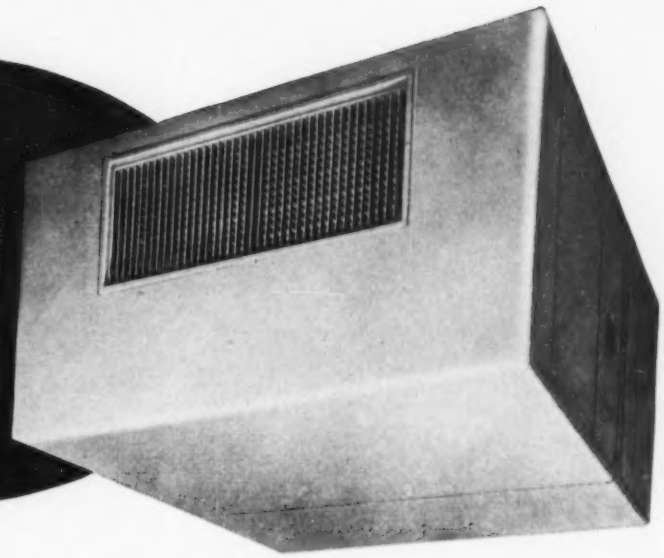
The Duplex Unit above, has two separate float switches to control each pump independently.

Skidmore builds a type for every installation.

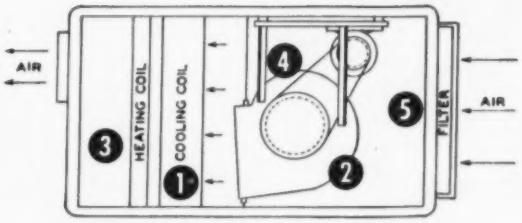
Write for bulletins on other heating pumps.

SKIDMORE CORPORATION ● ST. JOSEPH, MICHIGAN

NEW FEATURES of PROVEN MERIT



KRAMER AIR CONDITIONING UNITS



(1) MUGGY-AIR-CONTROL

It "squeezes" extra moisture from the air on muggy days without reheating, dampers or excessive cooling. No short cycling and uncomfortable conditions.

(2) "BLOW-THROUGH" DESIGN

Fan-motor assembly always exposed to normal room temperatures. A unique design with many advantages, resulting in —

No motor overload and no loss of bearing lubricant from hot air of the heating coils.

No corrosion of fan-scroll assembly from moisture carry-over of the cooling coils.

(3) ANTI-SWEAT CONSTRUCTION

Only a small portion of the casing is exposed to cooled air; that section is heavily insulated.

Access doors and grille have scientific anti-sweat designs.

(4) QUIET OPERATION

The fans and motor form an integrated assembly independently rubber-mounted to the casing. All moving parts are completely isolated by rubber.

(5) FOR FINISHED INTERIORS

Graceful lines with no unsightly belts, motor and guards exposed to view. Finished in hammer gray enamel.

MANY OTHER OUTSTANDING FEATURES.

WRITE FOR BULLETIN AC-238

KRAMER TRENTON CO. • Trenton 5, N.J.

Stainless Steel

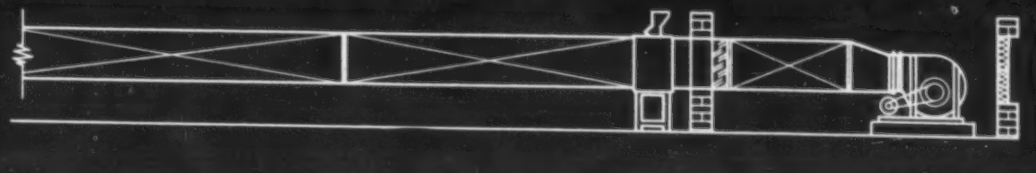
duct furnaces are manufactured by the

HAYES Furnace Co. used in series with coolers and refrigeration systems for longer life

Please write for catalog and nearest representative

HAYES Furnace
Mfg. & Supply Co.

2929 South Fairfax Ave., Los Angeles 16, Calif.
Telephone: Texas 0-3734



WHEN YOU SEE THE GOOD WILL you gain—when you make Dorex Air Recovery part of your air conditioning and ventilating installations—you'll be thankful indeed. Every $100 your clients invest in Dorex Air Recovery should save them about $400 on original equipment; and every $1 spent for Dorex maintenance over the years should lop about $4 off operating costs. The reason is simple—

Dorex Air Recovery "manufactures" *fresh* air by taking the odors and gaseous impurities out of *used* air. So there is far less outside air to heat or cool. But savings aside, Dorex Air Recovery is well worth while merely for its ability to maintain air freshness and abate odor nuisances common to many manufacturing processes.

Twenty years of experience and more than 10,000 installations back up the claims made for Dorex Air Recovery. You'll find the full story in our fact-packed bulletin: "How to Manufacture Fresh Air." Mail the coupon today for your copy. Connor Engineering Corporation, Danbury, Conn.

CONNOR ENGINEERING CORPORATION

dorex®
air recovery

CONNOR ENGINEERING CORP.
Dept. A-103, Danbury, Connecticut
Please send me, without obligation, full information on Dorex Air Recovery.

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City.....Zone.....State.....

..FACTS ABOUT CORK for Low Temperature . . .

CORK is one of the most useful materials known to man. Not only has it been in service longer than history can record, but its use has greatly increased with the need for modern industrial efficiency and economy. The reason for this is that Cork is completely unique in its physical structure and qualities. There's *nothing* like Cork!

1. Cork is MONEY-SAVING! Millions of dead-air cells in every square inch of Cork insulation cause it to serve as a most efficient *natural* barrier to heat flow. By its use, refrigeration is conserved to the most practical limits.

2. Cork is LONG-LASTING! Cork has high structural strength and is a most durable material. It continues to serve for many years at highest efficiency.

3. Cork is TIME-TESTED! The use of Cork insulation has kept pace with the development of refrigeration and cold storage. Its wide acceptance in these "heavy-duty" industries is due to its proved record for more than 40 years.

Write for FREE copy of Mundet Insulation Manual

4. Through more than 80 years as Cork specialists, we are able to preserve Cork's natural advantages in Mundet insulating products. Mundet engineers give you responsible assistance in building or expanding low temperature facilities. Let us help you secure low operating cost and maximum service. Mundet Cork Corporation, Insulation Division, 7101 Tonnelle Avenue, North Bergen, N. J.

Mundet district offices are conveniently located coast-to-coast.

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601 Second Ave.
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KNOXVILLE
1221 Grand Avenue
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(Maywood)
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3176 Brannon Ave.
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440 Brannan Street
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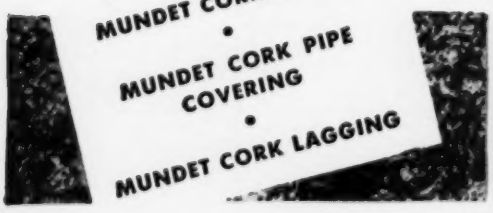
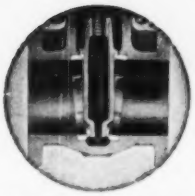
In Canada:
Mundet Cork & Insulation, Ltd.
35 Booth Avenue, Toronto

Write us for name of our nearest representative if there is no Mundet office in your city.

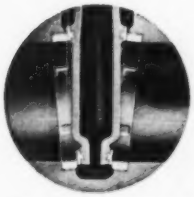


MUNDET
CORK INSULATION

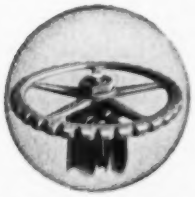
CONSERVES LOW TEMPERATURE



Straight-Flow Port Design reduces fluid turbulence to a practical minimum.



Seat Rings of end-seated type are screwed into the body.



Sure-Grip Malleable Handwheel for non-skid gripping even with heavy gloves.

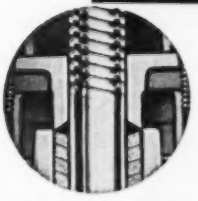
WALWORTH

iron body gate valves

with screwed or flanged ends

... 8 Outstanding Features

For complete information on these new Walworth Iron Body Valves, see your local Walworth distributor, or write for bulletin 106.



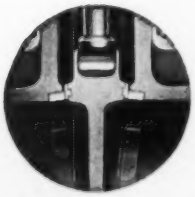
Brass Liner on Glands assures greater resistance to corrosion and scoring.

WALWORTH

valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

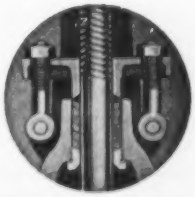
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



T-head Disc-to-Stem connection on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.

Bronze Back-Seat Bushings in bonnets of OS&Y valves.

Solid Web Type Disc in OS&Y valves for greater strength and longer service.



Hinged Gland Eye-Bolts on OS&Y valves permit faster, easier repacking under full pressure.

YOU BUY GOOD TOOLS

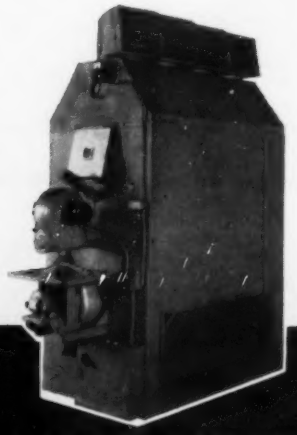
Experience teaches the all-important lesson that it's "penny wise and pound foolish" to invest in cheap tools. They do a poor job and last a short time.

This lesson may be also projected to industrial heaters — they must be dependable around the clock and for many years — they must be built really rugged. The Olson Company is proud to say, they more than meet these requirements. And, Olson Heaters provide a rigid base free from vibration, low fan speed, oversize drive, heavy shaft, large self-aligning ball bearings, heavy outside housing with radiation shields, ample relief and access doors.

The fact that Olson Heaters are built rugged for dependable service can not be denied — Write for the detailed step-by-step catalog and you'll know why.

Olson

DIRECT FIRED HEATERS
Gas, Oil, Coal or Dual Gas and Oil



Arthur A. Olson & Company
Canfield, Ohio
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ARTHUR A. OLSON & COMPANY
BROAD ST. · CANFIELD, OHIO

This residential heating system, including an electronic precipitator, was installed by the Limbach Company, Pittsburgh, Pa.

For tricky remodeling jobs . . . U·S·S Galvanized Steel Sheets

NEAT seams, tight joints and quality workmanship—on all sorts of new or modernization residential heating jobs—call for good sheets that handle easily, work up nicely. U·S·S Galvanized Sheets are uniform in ductility, flatness and surface finish; they make it easy to handle difficult shapes and angles on residential jobs like the one shown here.

You can bend, roll, cut or stamp these steel sheets in minimum time with satisfactory results. Soldering is no problem. And their tightly adhering zinc coating is highly resistant to cracking and flaking, assuring a long-lasting finish that contributes to the pleasing appearance and quality of every job you turn out.

U·S·S Galvanized Sheets are one of the best-known, most widely-used sheets in the industry. And the U·S·S trade-mark is your assurance of continuing dependable quality. Your customers know and appreciate the U·S·S name. It will pay you to take advantage of this widespread customer acceptance by using U·S·S Galvanized Steel Sheets on all your jobs.

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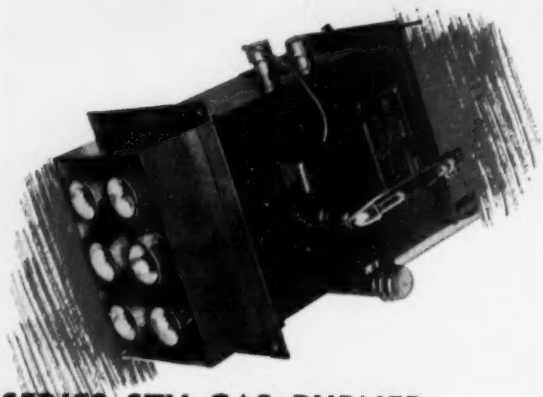
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S GALVANIZED STEEL SHEETS

3-470

UNITED STATES STEEL

JZ JOHN ZINK BURNERS *for All* HEATING *and* POWER NEEDS

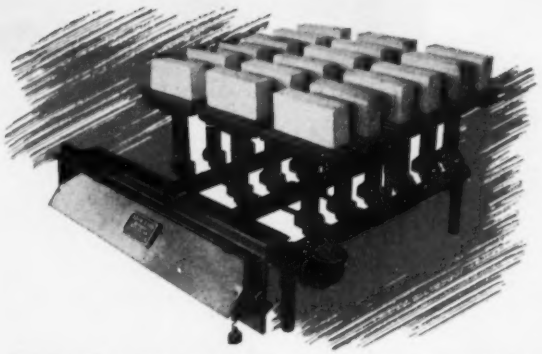


SERIES STV GAS BURNER

4" to 2#

Ideal for heating boiler installations. From one head to fifty heads. Quiet, efficient and economical operation.

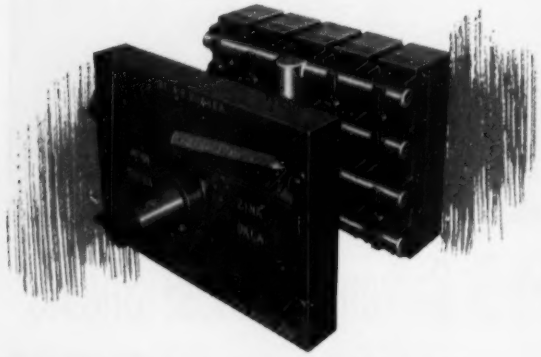
Write for literature.



SERIES VR VERTICAL GAS BURNER

4" to 4 oz.

This burner is one of the "upshots" or vertical radiant type with multiple burner heads so designed as to entrain a certain amount of primary air from the total air entering through the louvre. The "VR" burners are especially designed to operate in boilers having low draft and small combustion space.

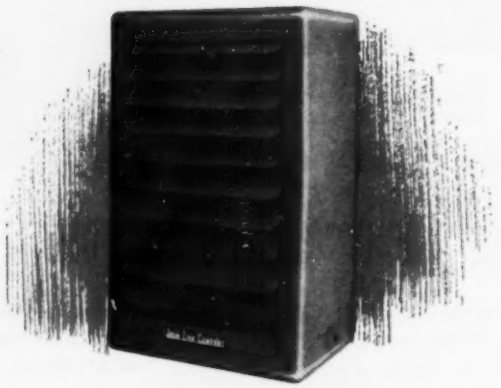


SERIES "R" BI-AIR BURNER

4" to 1#

For all types and sizes HEATING BOILERS and small Power Boilers — JOHN ZINK offers the Series "R" Bi-Air short flame, Gas Burner with Multi-Jet burners, having refractory semi-venturi mixing throats, with a separate gas orifice to each throat. Capacities to meet your requirements.

Especially adapted for installing in boilers having very low draft and small combustion space.



SUSPENDED UNIT HEATER

The John Zink UHS Gas-fired fan type suspended heater is a complete, packaged unit and fully automatic. A. G. A. approved for natural, mixed, manufactured or LP Gas.

New JZ Units for '53

Dual Cooling and Heating Unit for all weather conditioning.

•

New Single Cabinet

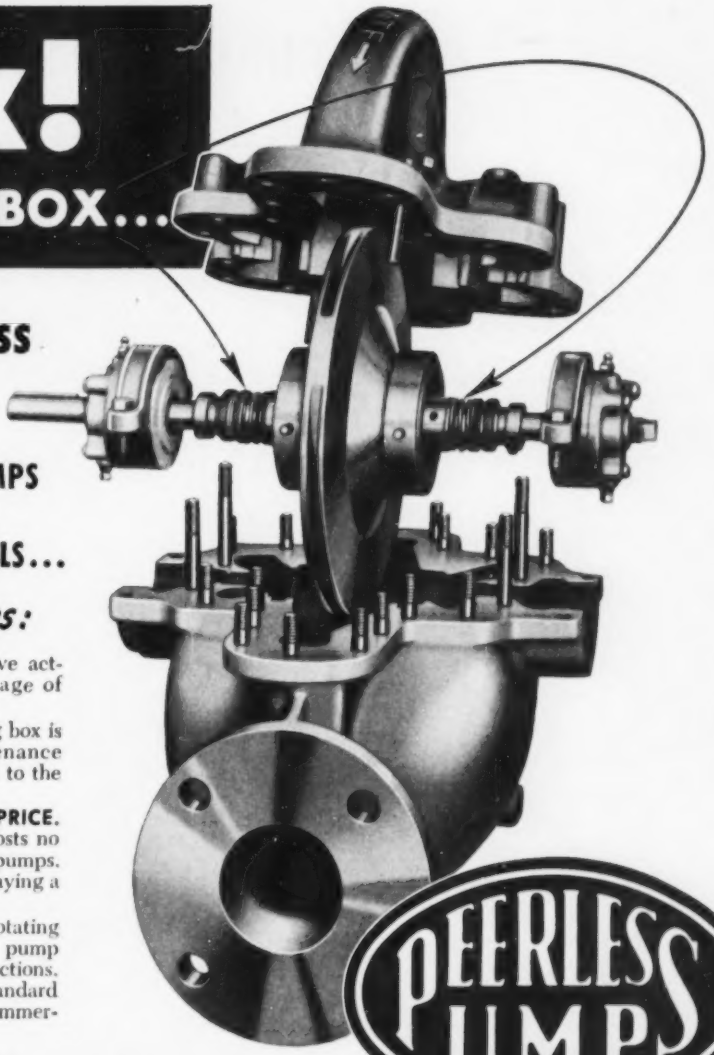
Central Heater with provision for later installation of cooling unit.

WRITE FOR LITERATURE

JOHN ZINK COMPANY

4401 South Peoria Tulsa 3, Oklahoma

LOOK!
NO STUFFING BOX...

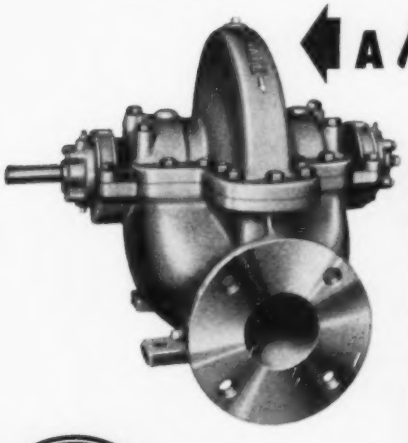


THE NEW PEERLESS TYPE AS GENERAL PURPOSE PUMPS are designed around MECHANICAL SHAFT SEALS...

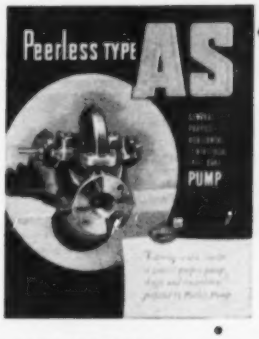
Here are 4 Big Advantages:

1) **NO LEAKAGE.** Simple, positive acting, shaft seals prevent leakage of liquid from pump.
2) **LESS MAINTENANCE.** Stuffing box is completely eliminated; maintenance trouble and expense is reduced to the minimum.
3) ***CUSTOM* PUMP–*STANDARD* PRICE.** The Peerless Type AS pump costs no more than ordinary split-case pumps. You get extra quality without paying a premium.
4) **EASILY SERVICED.** Entire rotating element can be removed from pump without disturbing line connections. Shaft seals and bearings are standard items, easily available from commercial sources.

PEERLESS PUMPS



A *NEW* PUMP
A *NEW* BULLETIN



Write for Bulletin No. B-1350 which completely describes and illustrates the modern design and construction features of Peerless Type AS pumps.

PEERLESS PUMP DIVISION
Food Machinery and Chemical Corporation
301 West Avenue 26, Los Angeles 31, California

Please send us a copy of Bulletin No. B-1350 describing Peerless Type AS pumps.

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____

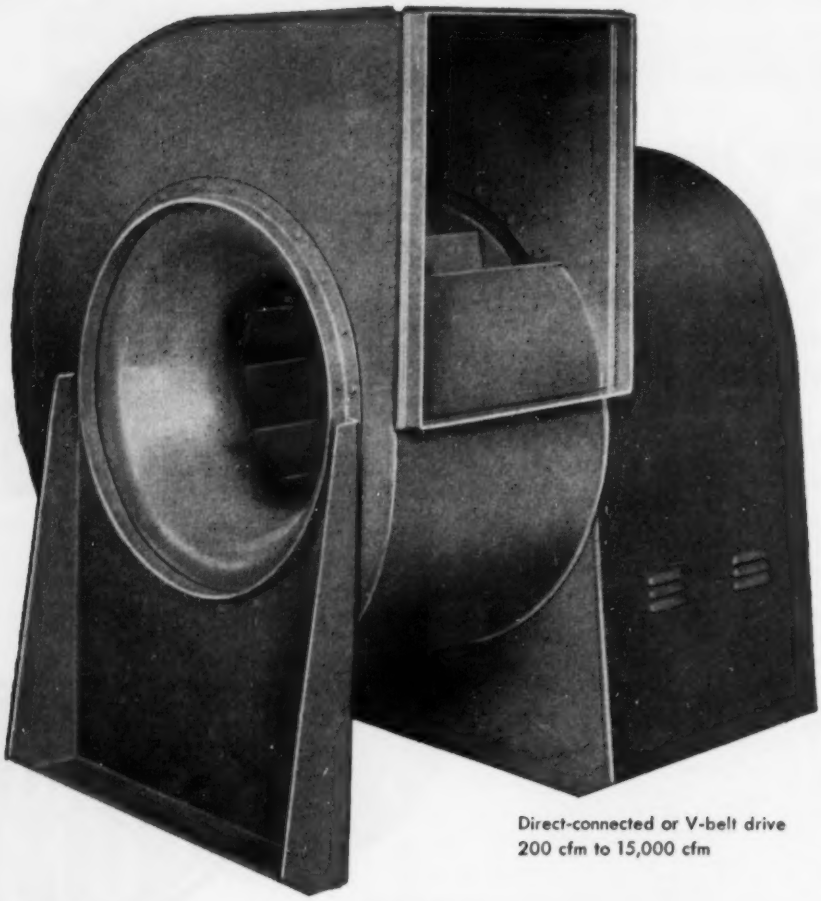
HP&AC

PEERLESS PUMP fmc

PEERLESS PUMP DIVISION
Food Machinery and Chemical Corporation
Address inquiries to Factories at:
Los Angeles 31, Calif. and Indianapolis 8, Indiana
Offices: New York, Chicago, St. Louis, Atlanta, Dallas, Plainview and Lubbock, Texas; Fresno; Los Angeles, Phoenix; Albuquerque, N. M.; Tulsa.

NEW!

ALL-PURPOSE VENTILATING SETS YOU CAN PUT INTO SERVICE FAST!



Direct-connected or V-belt drive
200 cfm to 15,000 cfm

Here's a new line of Westinghouse motor-driven ventilating sets. They are ideal for general purpose ventilation, for exhaust, for processes, and for removal of heat, fumes and vapor.

Where changing plant or building conditions create an unexpected need for ventilation, these sets are a quick solution. Here's why:

COMPACT SIZES—down to 10" x 12" x 16"—take little space, are easy to install.

SINGLE UNIT—fan, motor and drive all made and assembled by Westinghouse.

DIRECTION OF DISCHARGE—can be changed on the job.

LOW MAINTENANCE permits use of out-of-the-way locations.

WEATHERPROOF COVERS permit outside installation.

SHORT DELIVERIES get your job started sooner.

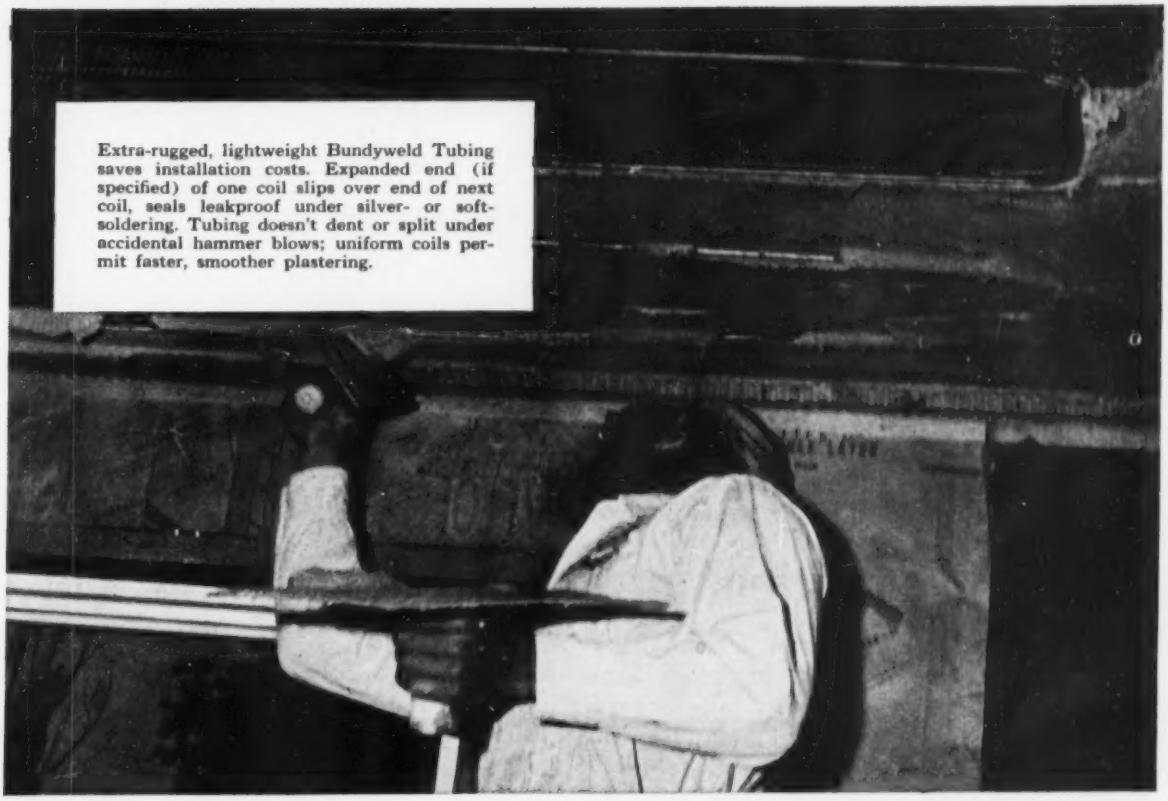
These ventilating sets are low in first cost, low in operating cost. You get a single warranty because fan and motor are both built by Westinghouse.

For other exclusive features and full information, ask for Catalog 1160. Call your local Westinghouse-Sturtevant office. Or, write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park 36, Massachusetts.

WESTINGHOUSE AIR HANDLING

J-80317

YOU CAN BE SURE ... IF IT'S Westinghouse



Extra-rugged, lightweight Bundyweld Tubing saves installation costs. Expanded end (if specified) of one coil slips over end of next coil, seals leakproof under silver- or soft-soldering. Tubing doesn't dent or split under accidental hammer blows; uniform coils permit faster, smoother plastering.

It's *easy* to make competitors "also-rans" through Bundyweld Ceiling Radiant Heating

Key to Low Cost

Bundyweld is the only tubing double-walled from a single strip, copper-brazed through 360° of wall contact. It's leakproof, thinner walled, yet stronger. It transmits heat quickly, has high bursting strength. It saves on material costs and installation time.

Standard 20' lengths of Bundyweld are easily formed into coils in shop or on job site. Expanded ends (furnished when specified) are quickly silver- or soft-soldered into leakproof union. Joined, lightweight coils are easily mounted onto ceiling, quickly plastered over.

There's an easy way to make "also-rans" of your local competitors, to make their prospects *your customers.*

How? By meeting customer demand for the heating system that makes all others obsolete; by offering Bundyweld Ceiling Radiant Heating.

By *user* testimony, this revolutionary *new* system brings gratifying freedom from drafts, dust, soot; eliminates space-stealing radiators or registers; is even-temperatured and economical, postponing redecorating *years.* These proved advantages have impressed themselves on thousands of near-ready home buyers and builders through Bundy ads in *Better Homes & Gardens, American Home, Small Homes Guide,* and *House Beautiful.*

Contractors find rigid, lightweight, leakproof Bundyweld far easier, quicker to bend and position than any other tubing. Silver- or soft-soldering gives a leakproof union; uniform coils speed plastering.

Sales are aided by our replies to requests for literature, *names* of plumbing and heating contractors handling Bundyweld Ceiling Radiant Heating. Simple to install, it makes sales. Mail coupon *now* for the full story.

Radiant Heating Division
BUNDY TUBING COMPANY
Detroit 14, Michigan

SEND FOR FREE LITERATURE!

LIKE HAVING THE SUN IN YOUR CEILING

Bundyweld Ceiling Radiant Heating

→ Radiant Heating Division, Dept. HP-1053
Bundy Tubing Company, Detroit 14, Mich.

☐ Send free 20-page nontechnical brochure explaining Bundyweld Ceiling Radiant Heating.
☐ Send Bundy technical radiant heating pamphlet.

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Address_____
City_____ Zone____ State_____

REMOTAIRE

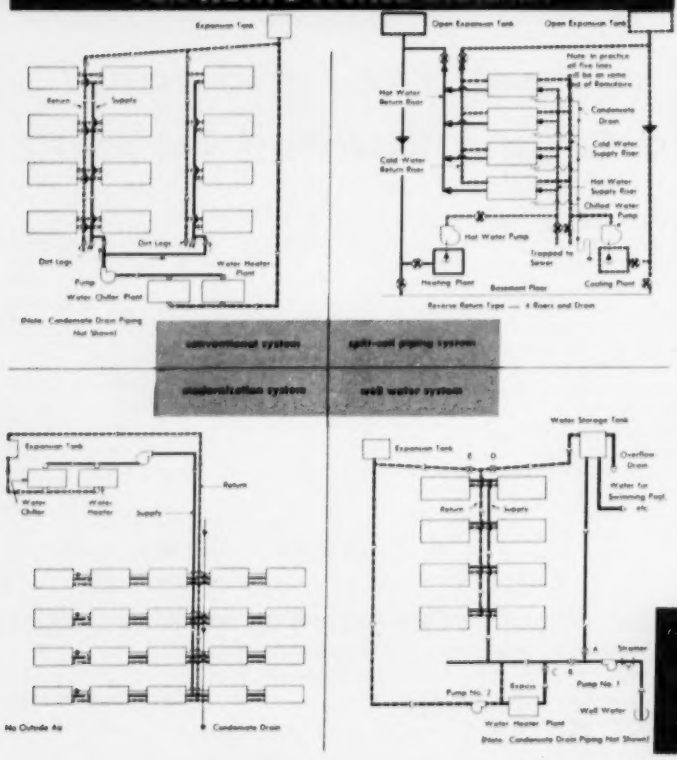
ROOM CONDITIONER

individual-room, remote-type units providing year 'round air conditioning for central plant multi-room installations

Adaptable to the one system that's most efficient, most economical for the job...

WALL APERTURE SYSTEM • INTERIOR VENTILATION SYSTEM • WELL WATER SYSTEM
SPLIT-COIL SYSTEM • MOTEL SYSTEM • RESIDENTIAL SYSTEM • MODERNIZATION SYSTEM

SOME TYPICAL PIPING ARRANGEMENTS FOR REMOTAIRE SYSTEMS:



● The Remotaire room conditioner heats in winter, cools in summer . . . filters and circulates the air all year 'round. Using chilled water from a central water chiller for summer cooling and hot water from a central heating plant for winter comfort, the Remotaire system provides clean, draft-free, healthful comfort-conditioning for multi-room installations such as hotels, motels, schools, hospitals, office buildings and residences.

A Remotaire system is versatile. It can be adapted to the system of air conditioning that is best suited to each building . . . new construction or modernization. Ventilation can be provided in a variety of ways . . . several methods of piping arrangements are possible. Since units can be installed free standing or recessed partially or completely, they afford wide flexibility in architectural planning.

As part of a Remotaire system, individual unit control permits each room occupant to choose the temperature that suits him best without affecting adjoining rooms. And when the unit is not in use it can be completely turned off, thereby reducing operating costs.

For further details on the various Remotaire systems, write for descriptive literature.

AMERICAN-Standard
AIR CONDITIONING

American Radiator & Standard Sanitary Corporation, Dept. HP-103, Pittsburgh 30, Pa.

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

LADISH *Controlled Quality* ASSURES METALLURGICAL SOUNDNESS

TENSILE TEST
One of many comprehensive Ladish laboratory test procedures for assuring reliable performance.

Photographed in Ladish Metallurgical and Research Laboratories

TO MARK PROGRESS

Testing the breaking point of metal... proves Ladish fittings have ample strength to meet the test of maximum service

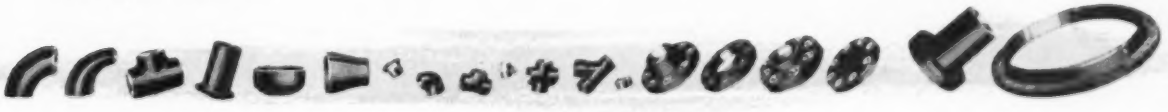
Optimum strength — proved by scientific test — typifies the outstanding values in Ladish fittings that result from special emphasis on sound metallurgy and advanced facilities. Shown here is modern Universal tensile testing equipment on which ultimate strength, yield strength, reduction of area and elastic properties are carefully measured to assure users of Ladish Controlled Quality fittings the metal quality essential for reliable performance.

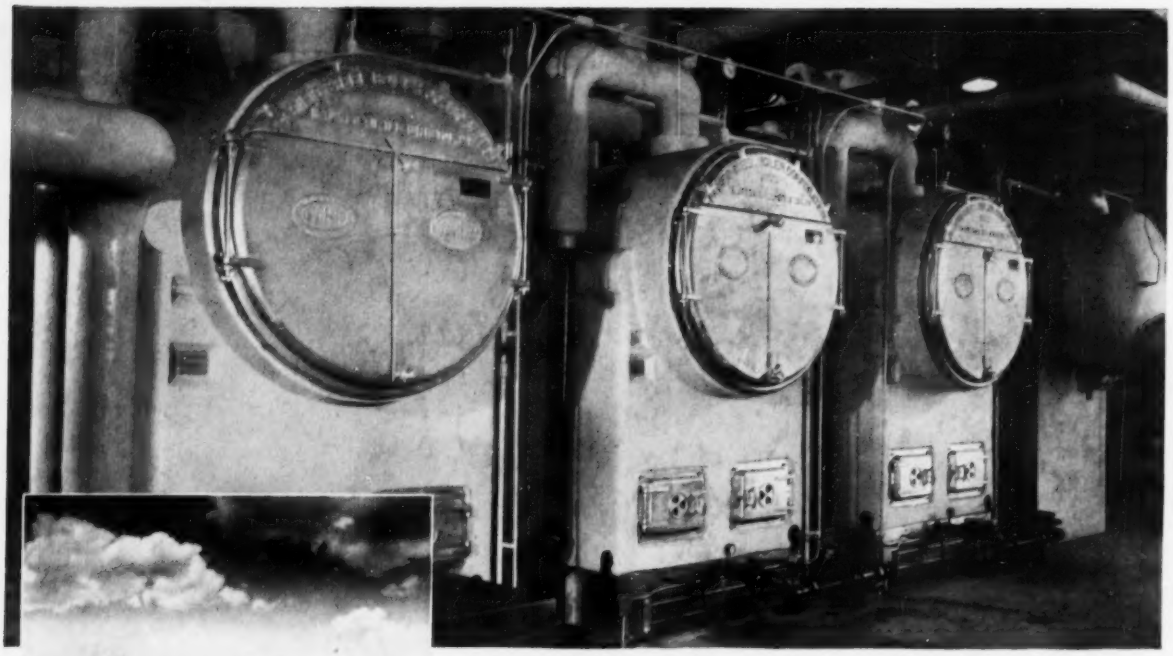
THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF... ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul • St. Louis • Atlanta • Houston • Tulsa • Los Angeles • San Francisco • Havana • Mexico City • Brantford, Ont.





The three Pacific Boilers with Forced Circulation installed in the Alexander Graham Bell Junior High School, Tulsa, Okla. Architects, Black & West; Consulting Engineers, Collins & Gould; General Contractor, W. R. Grimshaw & Co.; Mechanical Contractor, Bearden Plumbing & Heating Co.

Pacific Boilers with Forced Circulation are becoming standard equipment for schools

All over the country, the efficiency and economy possible with Forced Circulation are making Pacific Boilers first choice for schools.

Here's another of the many new schools built in the last few years in the Oil Capitol of the World, Tulsa, Oklahoma. Like most of the others, it uses Pacific Boilers with Forced Circulation for heating.

Forced Circulation is simply the action made possible by Pacific's exclusive Circulating Connections. They channel the hot water and steam from the water leg and project them at high velocity across the heating tubes. This rapid action scrubs the insulating steam bubbles off the tubes and allows maximum heat transfer. That means greater efficiency, lower fuel bills.

Your Pacific representative can give you all the facts on Forced Circulation. He can also give you the data you need on the proper Pacific Boiler types and sizes for all your jobs. Why not call him today.

Torry School, Birmingham, Mich.

Junior High School, Artesia, N.M.

St. Theresa's School, Marblehead, Mass.

Designed Constructed and Stamped in Accordance with **ASME** Code

SBI

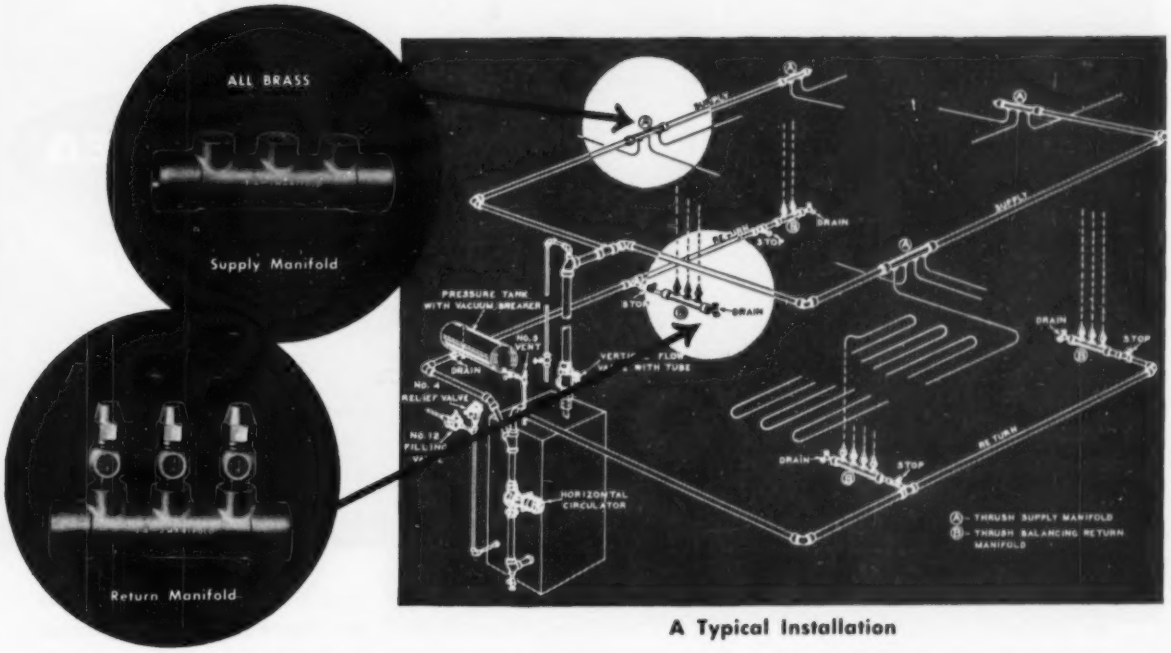
PACIFIC

Pacific Steel Boiler

DIVISION • UNITED STATES RADIATOR CORPORATION

GENERAL OFFICES: DETROIT 31, MICHIGAN

new THRUSH products to SIMPLIFY RADIANT HOT WATER HEATING



A Typical Installation

Save Space, Time and Labor

THRUSH MANIFOLDS

Installing radiant coils is easier with Thrush Manifolds. They save time, space and fittings. Available in 1" and 1¼" sizes, each with two, three or four ⅜" or ½" threaded branch outlets. Ends have solder connections. Thrush Manifolds are used in both supply and return lines.

THRUSH BALANCING VALVES

It is easy to balance radiant coils with these valves in the Manifolds. They permit the individual filling of each coil and save time. Air is eliminated quickly and completely. Positive shut-off. Flared fittings for ⅜" and ½" tubing. See your wholesaler or use the coupon below.

for better balanced heating ➡

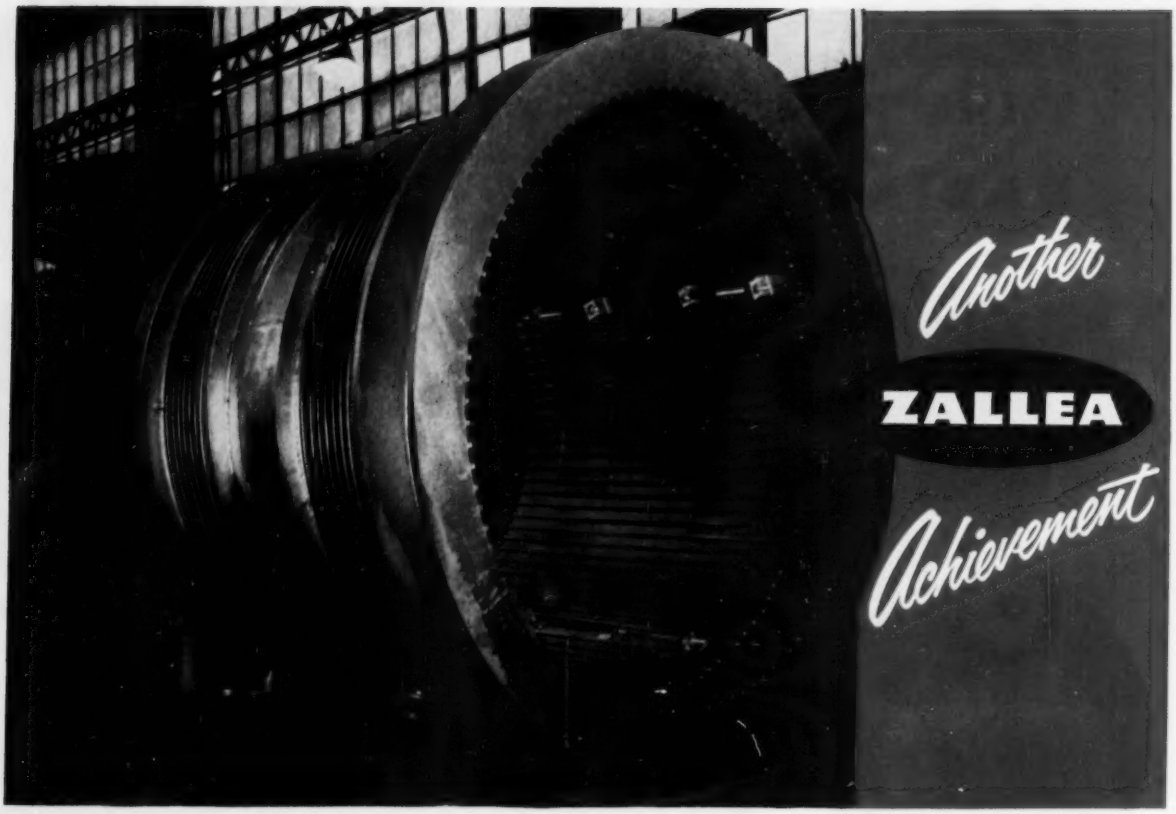
H. A. THRUSH & COMPANY

H. A. THRUSH & COMPANY • DEPT. E-10 • PERU, IND.

Please send us illustrated bulletin on Thrush Manifolds and Balancing Valves.

NAME _____ ADDRESS _____

CITY _____ STATE _____



In the almost quarter century that we have been in business, we have been called upon to develop and produce many highly specialized types of expansion joints. None, however, have been more spectacular than the 109-inch joints recently developed for use in testing equipment for aircraft engine prototypes. These low pressure joints were designed with a hundred internal tie bars, which permit the joints to absorb the lateral deflection between a long exhaust header, operating at 650° F. and a series of large gas coolers, without the need for heavy anchors. Eight of these joints are now in service in a classified defense project.

This is just another example of how Zallea engineers, with the experience gained from specializing in one product—expansion joints, are able to successfully and economically solve the most difficult problems confronting this type of industry.

But this is not all—we regularly manufacture a complete line of expansion joints capable of service in virtually any type of expansion application. These joints are available in diameters from 3 inches to 30 feet for temperatures from subzero to 1600° F. . . . for pressures from vacuum to 300 psi in standard designs and up to 2,000 psi in special designs.

For full details regarding your expansion joint problems or requirements, just get in touch with us. Zallea Brothers, 816 Locust Street Wilmington 99, Delaware.

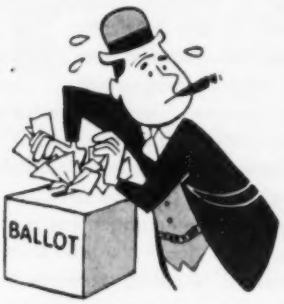
For detailed information on Zallea Expansion Joints and services write today for a free copy of Bulletin 351.

Zallea
EXPANSION JOINTS

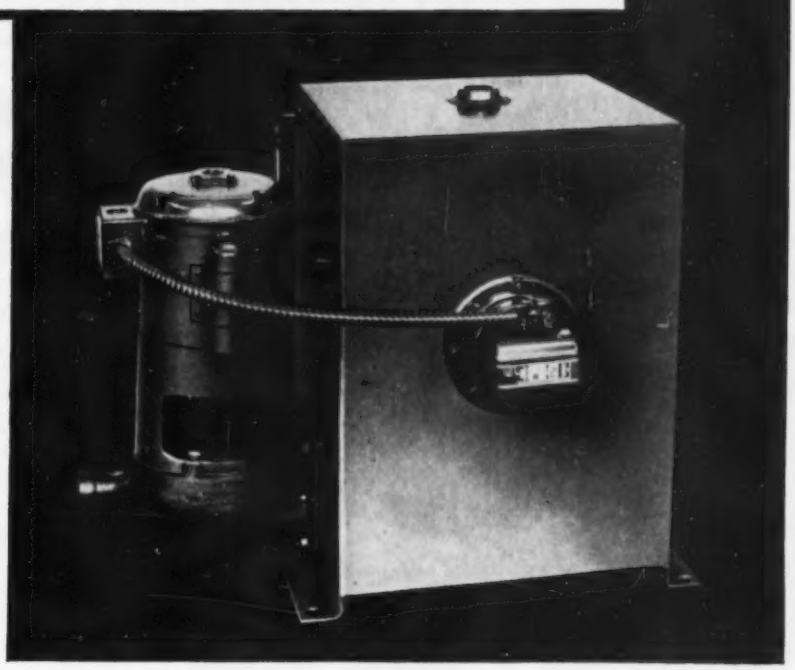
WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS

HOW TO KNOCK THE "STUFFINGS" OUT OF MAINTENANCE COSTS

"No close clearance parts"



"No stuffing box worries"

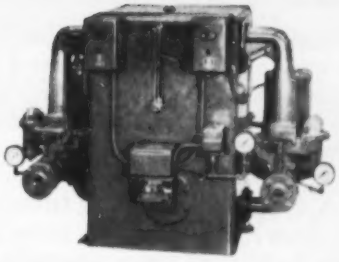


Packing a stuffing box is a lost art . . . as far as improved Dunham Condensate Pumps go. There's just no need for it. That's all taken care of by Dunham's new mechanical seal.

In addition to simplified stuffing box maintenance, these pumps cut costs all down the line. *Installation costs* are low since four anchor bolts secure pump to floor. No bars or bed plates. Return line connections are low, too.

Operating and Maintenance Costs are less because Dunham Condensate Pumps don't depend on close clearances to hold their rated discharge and pressure. These new pumps also have new low motor horsepowers per EDR.

And First Costs on this newly expanded line are lower than ever before. For full information, just clip and mail the coupon.



Dunham Vacuum Pumps pull and maintain up to 26" of vacuum . . . without dependence on close clearances . . . and at low amperage. Only one principal moving part. Low level return line connections eliminate "pitting." Side-mounted motors. Single and duplex models.

DUNHAM CONDENSATE PUMPS

RADIATION • UNIT HEATERS • PUMPS • SPECIALTIES

QUALITY FIRST FOR FIFTY YEARS

C. A. DUNHAM COMPANY • CHICAGO • TORONTO • LONDON

C. A. DUNHAM COMPANY
Dept. HPAC-10, 400 W. Madison St.
Chicago 6, Illinois

Send Condensate Pump literature.

Name_____

Firm_____

Address_____

City_____ Zone___ State_____

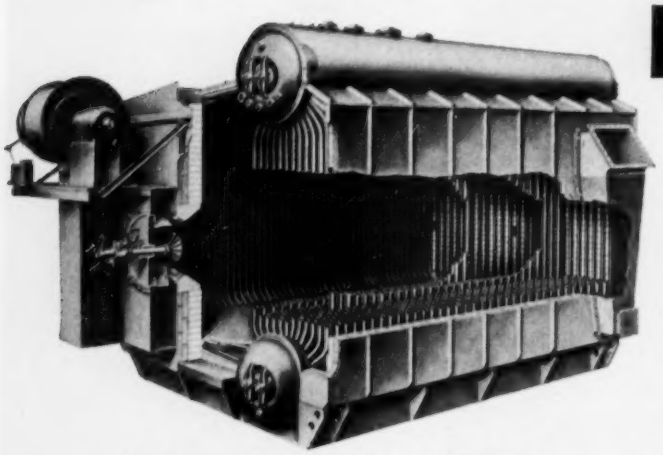
FOR STEAM CAPACITY up to 60,000 POUNDS

Choose your boiler from these two

If you burn oil or gas, investigate the VP Package Boiler for capacities up to 30,000 pounds per hr . . . the VU-10 up to 60,000 pounds.

For stoker firing, the VU-10 is available from 10,000 to 60,000 pounds of steam per hour.

Whatever your fuel . . . whatever your steam capacity requirements up to 60,000 pounds per hour — you'll find that one of the Combustion Engineering Boilers described below will be just right for you.



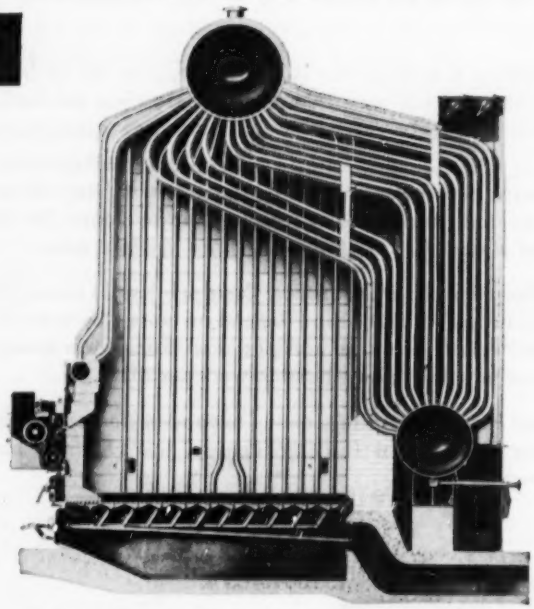
The VP Boiler — the Package Boiler with EXTRA Features

THE VP BOILER

The C-E Package Boiler, type VP . . . completely shop-assembled . . . for oil or gas firing. It is available in capacities from 4,000 to 30,000 lb steam per hr; for pressures to 250 psi. The VP Boiler has more water-cooled area per cubic foot of furnace volume than any other boiler of its size and type. The large (30-in. diameter) lower drum permits a simple, symmetrical tube arrangement . . . greater water storage capacity . . . easy access for washing down or inspection. The centrifugal fan is efficient, yet its noise level is less than half that of typical high-speed blowers used on most package boilers. Baffle arrangement is simple, resulting in low draft loss . . . simple soot blowing . . . elimination of dead pockets . . . high heat absorption.

THE VU-10 BOILER

The VU-10 Boiler is designed for industrial load conditions, particularly for plants with small operating and maintenance forces. Capacities range from 10,000 to 60,000 lb steam per hr . . . pressures to 475 psi . . . heat recovery equipment is available if desired. Fuel can be either coal (C-E Spreader, Traveling Grate or Underfeed Stoker) oil or gas. This boiler is a completely standarized design adaptable to many conditions. It responds readily to variations in load; it is simple to operate and maintain. All parts are easily accessible for inspection. Like the VP, the VU-10 Boiler is a complete unit — boiler, furnace setting, fuel-burning equipment, controls, forced draft — bringing you the benefit of one contract . . . one guarantee . . . one responsibility.



The VU-10 Boiler, as arranged for C-E Spreader Stoker firing

COMBUSTION ENGINEERING, Inc.

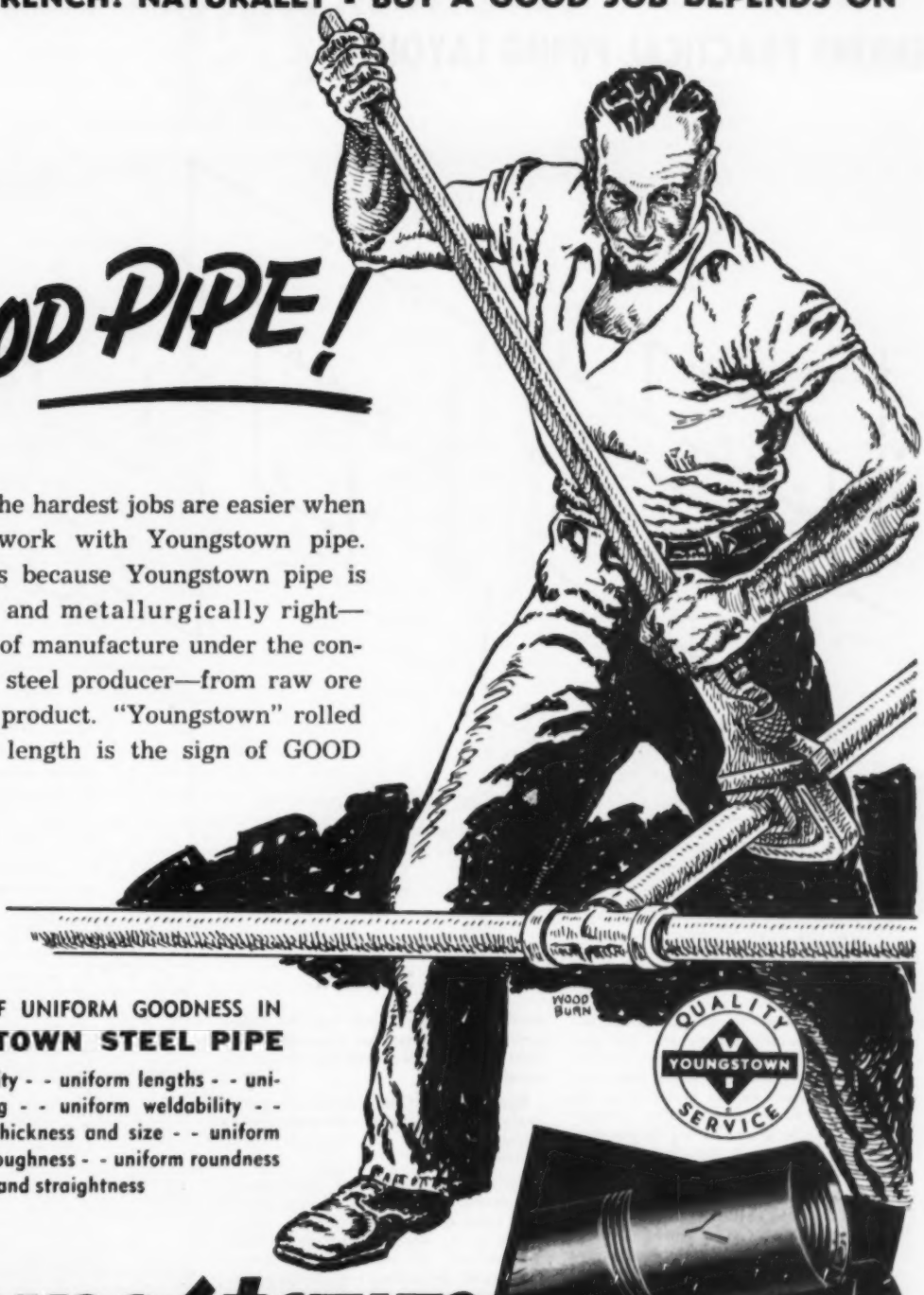
Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT

8-6898

GOOD WRENCH? NATURALLY - BUT A GOOD JOB DEPENDS ON

GOOD PIPE!



EVEN the hardest jobs are easier when you work with Youngstown pipe. That's because Youngstown pipe is chemically and metallurgically right—every step of manufacture under the control of one steel producer—from raw ore to finished product. "Youngstown" rolled into every length is the sign of GOOD PIPE.

7 POINTS OF UNIFORM GOODNESS IN YOUNGSTOWN STEEL PIPE

uniform ductility - - uniform lengths - - uniform threading - - uniform weldability - - uniform wall thickness and size - - uniform strength and toughness - - uniform roundness and straightness

QUALITY V YOUNGSTOWN SERVICE

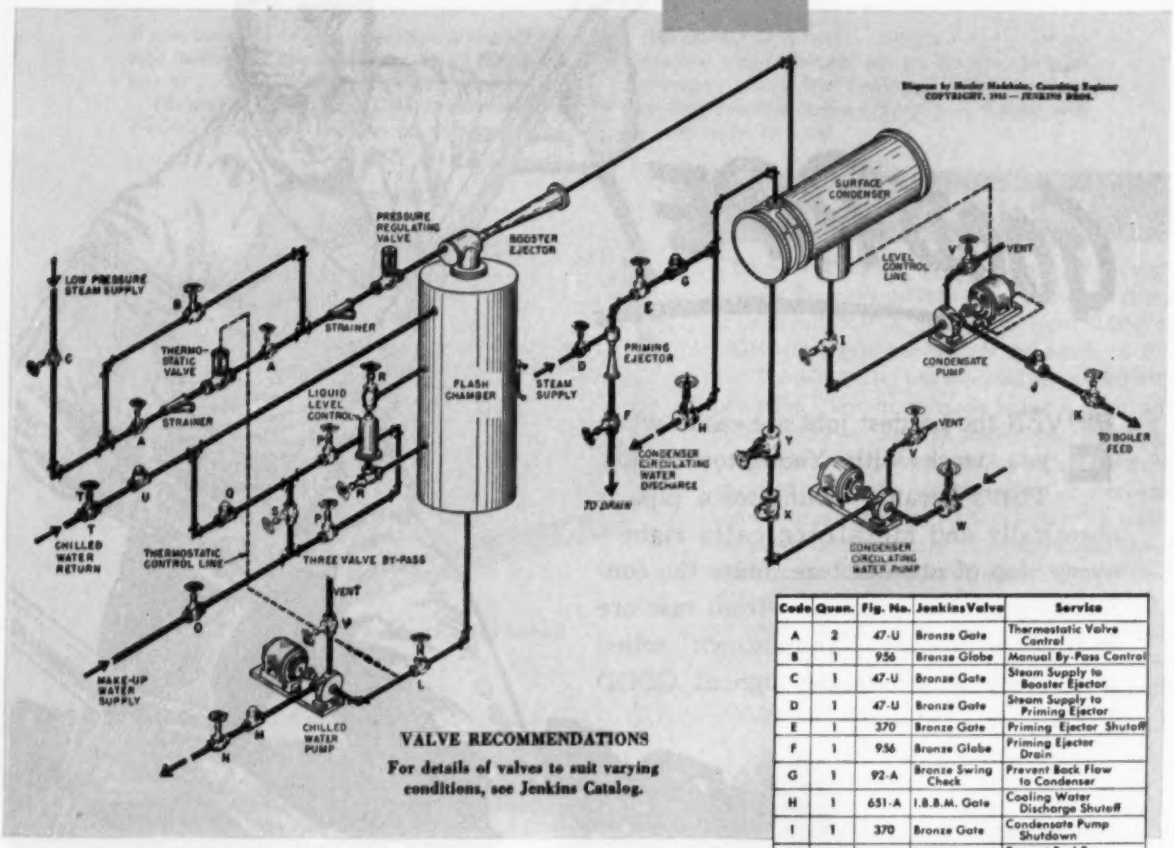
Youngstown STEEL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

General Offices: Youngstown, Ohio - Export Office: 500 Fifth Avenue, New York 36, N. Y.

PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS - COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RAILROAD TRACK SPIKES

JENKINS PRACTICAL PIPING LAYOUTS 69



VALVE RECOMMENDATIONS

For details of valves to suit varying conditions, see Jenkins Catalog.

Code	Quan.	Fig. No.	Jenkins Valve	Service
A	2	47-U	Bronze Gate	Thermostatic Valve Control
B	1	956	Bronze Globe	Manual By-Pass Control
C	1	47-U	Bronze Gate	Steam Supply to Booster Ejector
D	1	47-U	Bronze Gate	Steam Supply to Priming Ejector
E	1	370	Bronze Gate	Priming Ejector Shutoff
F	1	956	Bronze Globe	Priming Ejector Drain
G	1	92-A	Bronze Swing Check	Prevent Back Flow to Condenser
H	1	651-A	I.B.B.M. Gate	Cooling Water Discharge Shutoff
I	1	370	Bronze Gate	Condensate Pump Shutdown
J	1	92-A	Bronze Swing Check	Prevent Backflow through Condensate Pump
K	1	106-A	Bronze Globe	Condensate Pump Control
L	1	370	Bronze Gate	Chilled Water Pump Shutdown
M	1	92-A	Bronze Swing Check	Prevent Back Flow Through Pump
N	1	106-A	Bronze Globe	Chilled Water Pump Control
O	1	106-A	Bronze Globe	Make-up Water Control
P	2	370	Bronze Gate	Automatic Valve By-Pass
Q	1	92-A	Bronze Swing Check	Prevent Backflow from Chamber
R	2	108-A	Bronze Angle	Level Control Shutoff
S	1	106-A	Bronze Globe	Manual By-Pass Control
T	1	106-A	Bronze Globe	Chilled Water Control
U	1	92-A	Bronze Swing Check	Prevent Backflow Chilled Water Lines
V	1	106-A	Bronze Globe	Pump Vent
W	1	651-A	I.B.B.M. Gate	Condensing Water Pump Shutdown
X	1	624	I.B.B.M. Swing Check	Prevent Backflow to Pump
Y	1	613	I.B.B.M. Globe	Pump Control

How to plan a

STEAM JET REFRIGERATION SYSTEM

The use of steam for air conditioning has increased steadily during the past few years, principally because of the low cost of steam. In plants generating their own steam, demands on the boiler plant are greatly reduced during the summer months, while plants having to purchase district steam usually benefit by reduced summer rates.

In the steam jet system shown, water returned from the chilled water coils of the air conditioning system enters the flash chamber which is maintained at a low pressure by the booster ejector. Here the water is cooled to a temperature corresponding to the boiling point at the reduced pressure. Heat is removed by the flashing of a portion of the returned water to steam which is removed by the ejector.

The booster ejector used in this system requires either a barometric or surface condenser. Pump drives may be either electric or steam turbine, depending upon local operating costs and the size of the installation.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run*. Jenkins Bros., 100 Park Ave., New York 17.

• •

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 69.

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE

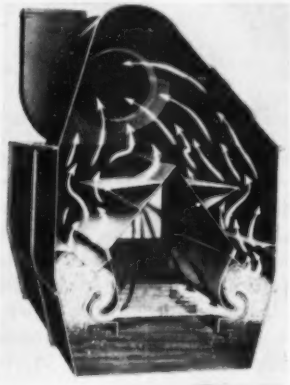
Jenkins Bros.

EQUIPMENT DEVELOPMENTS . . .

Add the new products and companies listed here to your Directory Section which you received in your January 1953 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

Hydrostatic Dust Collector

Design 4, Type N "Roto-Clone" dust collector, a hydrostatic precipitator that separates the dust from the air by means of an S-shaped water curtain. . . . It is available in three basic arrangements which provide manual cleanout, continuous drain and sludge ejection by flight conveyors. Each is identical in operating principle

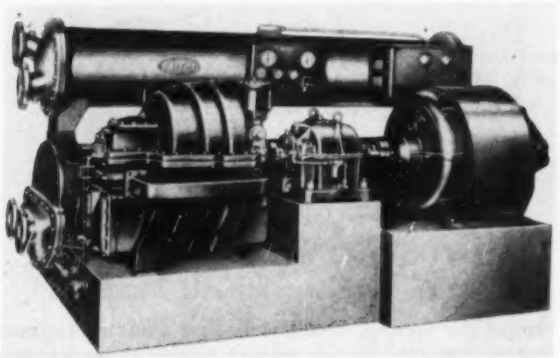


but differ in hopper design. Improved features include: nonplugging water entrainment separators; heavier sludge ejector mechanism; sectional construction to permit field conversion from one arrangement to another. Capacities range from 1000 cfm to 48,000 cfm.

Manufacturer—American Air Filter Co., 373 Central Ave., Louisville 8, Ky.

Centrifugal Refrigerating Machine

New line of small 75 to 200-ton centrifugal refrigerating machines. . . . Can be connected to electric motor, diesel or steam turbine drive and can be



adapted to automatic constant speed with synchronous motors. Operating speed can be selected for normal operation with above-normal condensing temperatures. According to the manufacturer, this feature may be used to reduce condenser water consumption by 40 or 50 percent in some areas. The impeller wheels are made of lead-coated alloy steel designed to prevent wheel failure by corrosion or vibration.

Manufacturer—Carrier Corp., 302 S. Geddes St., Syracuse 1, N. Y.

Chemical Solution Feed Pump

**Chemical solution feed pump for chlorinating industrial wastes, drinking water and swimming pools. . . . The pump operates as a positive displacement diaphragm type pump. A shaded pole electric motor and a reduction gear train, contained within an aluminum alloy casting and immersed in oil, reciprocate a diaphragm by means of an eccentric cam. This reciprocation causes the unit to pump solution from a container and inject it into the main water line. All parts that come in contact with the pumped solution are chemically resistant plastic or rubber. The pump can feed up to 60 gal of sodium or calcium hypochlorite solution a day, the manufacturer states. Other chemicals also used in water treatment can be used in the pump.

Manufacturer—The Bruner Corp., 2318 N. 30th St., Milwaukee 45, Wis.

Above: Pump
Left: Thermostat

Rate-of Rise Thermostat

A rate-of-rise thermostat designed to control the rate of heating and to prevent temperature overshoots in fast warm-up systems. . . .According to the manufacturer, this unit controls the rate of heat output during the warm-up period and aids in bringing the system up to the desired temperature. The thermostat unit may be used either with standard temperature controls or as a separate safety control. The "Thermoswitch" is hermetically sealed to protect the contact assembly against contamination. It can be set to actuate at any heating rate between 10 and 100 F per min at ambient temperatures between −100 and 550 F. Electrical rating is 5 amps at 115 volts, a-c, or 2 amps at 28 volts, d-c.

Manufacturer—Fenwal Inc., 130 Pleasant St., Ashland, Mass.

Brass and Copper Tubing

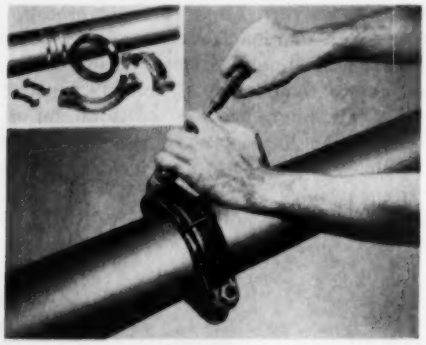
Manufacturer of electrical wire, cable and conduit soon will produce brass and copper tubing. . . .

Initially the company will make copper water tube, Types K, L, and M in standard sizes ¼ in. through 4 in. The tube is intended for use in underground water services, drainage systems, hot water, vapor and steam heating systems, expansion coils, gas service and plumbing. Types K and L will be produced in hard and soft temper in straight lengths of 20 ft. Small sizes of Type K and L (¼ in. through 1½ in.) will also be available in coils in the soft temper. Type M will be produced in straight lengths.

Manufacturer—Triangle Conduit & Cable Co., Inc., New Brunswick, N. J.

Coupling for Grooved Pipe

"Gruvajoint," a lightweight coupling for grooved pipe systems where pressures do not exceed 500 psi. . . . According to the manufacturer, the couplings automatically absorb expansion and contraction, shock, ground motion and vibration. The manufacturer also states that they remain leakproof under end pulls up to



7500 lb; permit layout misalignment up to 3 deg; withstand temperatures between 200 F and −65 F. They are designed for permanent or temporary lines carrying air, vacuum, gases, water, oil, chemicals and pulverized minerals and rock. "Gruvajoints" are available in 2, 3 and 4-in. sizes.

Manufacturer—Gustin-Bacon Mfg. Co., 210 W. 10th St., Kansas City, Mo.

Regulating Valve for Gas-Oil Burners

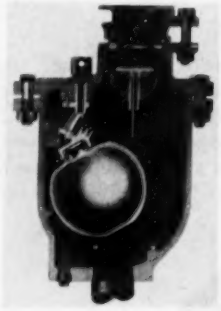
Oil pressure reducing and regulating valve for reducing high pressure to low pressure. . . . Designed especially for the manufacturer's closed flame gas-oil burners, the valve is a single seated, spring loaded, direct acting diaphragm type. According to the manufacturer, it automatically reduces high pressure to low pressure and maintains the low pressure regardless of fluctuations on the high pressure side. It is constructed so that any restriction forces the valve open with a self cleaning effect of the seat. A built-in strainer is included to guard the working parts.

Manufacturer—Eclipse Fuel Engineering Co., 1139 Buchanan St., Rockford, Ill.

Small Motor for Oil Burners

Fractional horsepower motor for high and low pressure oil burners, smaller and lighter than previous models. . . . The motor features reversible rotation in ⅛ and 1/16 hp ratings. Rotation can be changed by switching connections in a terminal box on the pulley-end flange face. According to company engineers, the ⅛ hp model weighs 11 lb and is 56 percent lighter than former models. Its insulation is designed to resist moist basement atmosphere. A manual reset thermal protector button is located on top of the motor close to the instruction nameplate.

Manufacturer—General Electric Co., 1 River Rd., Schenectady, N. Y.



Above: Motor
Left: Valve

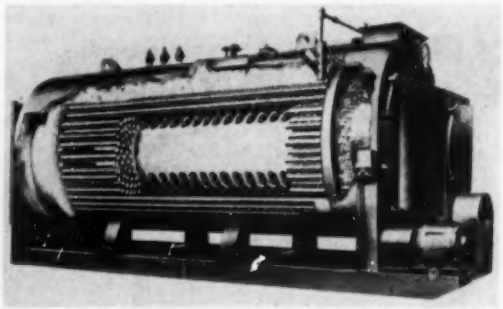
Air Release and Vacuum Breaking Valve

**Type "AV" air release and vacuum breaking valve. . . . It is designed to provide a compact unit having the functions of releasing automatically air accumulations from pipe systems, admitting air to systems for breaking vacuums within those systems and venting large quantities of air from pipe lines when filling systems with water. It has a 2-in. threaded inlet opening and is designed to be used under working pressures up to 150 psi. Maximum diameter is 11½ in. and the overall height is 16¼ in.

Manufacturer—Simplex Valve & Meter Co., 68th and Upland Sts., Philadelphia 42, Pa.

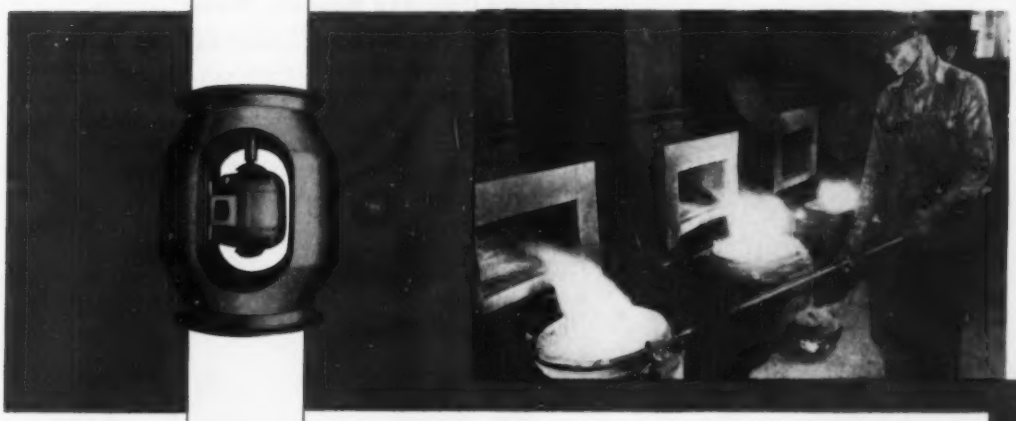
Packaged Boiler

Simplified and improved construction of boiler. . . . The automatic steam generator, 20 to 500 hp, features a two-pass design to eliminate the need for refractory baffles or a partition in front or at the rear. This design is reported to make possible easy and full access to all fire surfaces and to afford an improvement in uniformity of longitudinal expansion over the entire struc-



ture of the pressure vessel. In operation, air for combustion enters the furnace through tangential vanes around the burner register. The register is located in the furnace throat which is surrounded by the heated chamber for returning gas. After travel through the furnace tube, the hot gases are forced through the 3-in. return tubes with a spiraling motion. Under normal operating conditions, the stack temperature is designed not to exceed

HOW TO EXHAUST FUMES FROM BOILING BRASS . . . WITHOUT HOODS



In brass melting furnaces, normal temperatures run from 1850° to 2350° F. Terrific heat and irritating fumes are given off by these open furnaces.

To improve working conditions around their furnaces, Standard Brass Manufacturing Company of Kansas City, Missouri tried several fan and hood systems without success. Then they installed five DeBothezat Bifurcator Fans, one for each two furnaces. Bifurcators with 27" diameter fan wheels and 2 HP motors, operating at 1140 RPM, were selected. The high velocity of these DeBothezat Bifurcator Fans made it possible to use open ducts behind the furnaces in place of hoods above them.

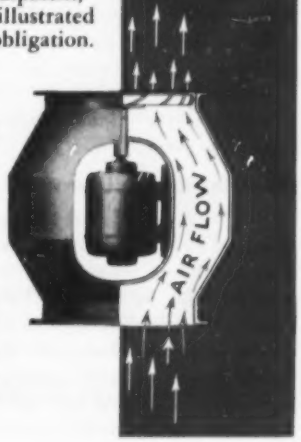
Now working conditions around the furnaces are satisfactory. And furnace charging and unloading is safer, easier and faster *without hoods.*

DeBothezat Bifurcator Fans are ideal for installation where space is limited, because they are compact, and install right in the duct work. Bifurcator Fans can be made of carbon steel, stainless steel, rubber coated steel, monel metal and many other corrosion or heat-resistant materials.

Ask your DeBothezat representative. You'll find him listed in the phone book under "Ventilating Equipment," or write our factory, Dept. HP-1053, for illustrated catalog DB-4-53. Either way, there's no obligation.

HOW BIFURCATOR WORKS

The Bifurcator is a motor driven axial-flow fan in a patented, divided housing. Motor is in an isolated chamber around which flue gases are by-passed (bifurcated) so that the motor always remains cool, clean and accessible. Bifurcators are available in many sizes from 1140 CFM (12" diameter fan with 1/20 HP motor) up to 45,000 CFM (48" diameter fan with 20 HP motor).



DeBothezat Fans

Division of American Machine and Metals, Inc.

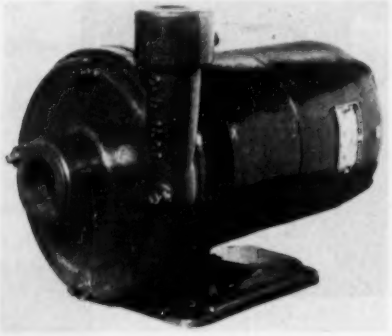
EAST MOLINE, ILLINOIS

125 F above saturated steam temperature at the operating pressure.

Manufacturer—Boiler Engineering and Supply Co., Continental Boiler Div., Manavon Rd., Phoenixville, Pa.

Close-Coupled Centrifugal Pump

Close-coupled centrifugal pump for air conditioning and refrigeration recirculation. . . . Available in capacities from 5 to 50 gpm, with heads to 105 ft, and ¼ to 1½ hp, it incorporates a standard NEMA motor frame for single or 3-phase, 60 cycle current. A hy-



draulically-balanced impeller and short pump-mounting bracket is designed to minimize shaft vibration. The vertically split, end-suction pump employs a variable four-position discharge and a self-lubricated mechanical shaft seal. It can be mounted horizontally, vertically, or at any angle.

Manufacturer—Marlow Pumps, Ridgewood, N. J.

Instrument for Interior Inspection

**Five power optical instrument designed for surface examination and inspection of hidden or recessed surfaces, wiring, joints, welds, contact points, interior tubular and cylindrical surfaces where direct inspection is difficult. . . . The "Inspecto-Scope" consists of

an eye piece, housing the optical system and the "en-tube" equipped with a bulb, mirror, mirror cover, light switch, battery cable and poles. The lighted area is at a 45 deg angle to the long axis of the 12-in. tube. The tube revolves 360 deg to allow the viewer to inspect inside surfaces without changing the position of the eyepiece.

Manufacturer—Badger Sales Co., Inc., 2251 W. Pico Blvd., Los Angeles 6.

Filter for Gas-Oil Burner

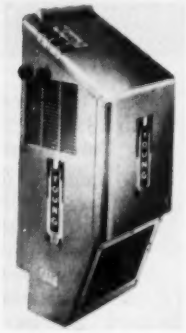
*Edge type plate filter for use with the company's "CF" closed flame gas-oil burner. . . . This filter is said to separate all solids from fuel oils without stopping the oil flow. Filtration is accomplished by passing the oil between discs of metal, separated by spacers of the proper thickness for the particular oil to be used. Solids larger than the spaces between the discs cling to the edges. The center space within the discs is connected to the filter outlet to provide a means for the filtered oil to leave. Solids accumulating on the cartridge are removed by turning a handle operating the cleaner blade. The cleaner blades are designed so all solids are removed and settled in the sump.

Manufacturer—Eclipse Fuel Engineering Co., 1139 Buchanan St., Rockford, Ill.

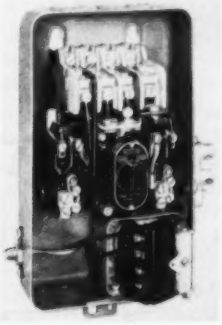
Pressure Operated Magnetic Starter

Pressure operated magnetic starter for use on pumps and air compressors. . . . The unit combines a starter, pressure switch and automatic unloader valve. It is available in three sizes up to 5 hp at 220-550 volts single phase or 10 hp at 440-550 volts polyphase. The pressure switch can be supplied in series "G" for 80 lb or series "H" for a maximum of 200 lb. The direct mounting of the control on the motor eliminates the problem of locating the control and reduces wiring and conduit requirements, the manufacturer states.

Manufacturer—Furnas Electric Co., McKee St., Batavia, Ill.



Heater



Starter

Utility Heater for Mobile Units

New developments in the "Utility" heater line, designed for mobile units and small space heating. . . . The heaters are built for use with 35 psi hot water or 5 psi steam systems. They may be free standing, wall hung or flush mounted. The heating core is composed of copper fins and brass tubes and tanks. Fully enclosed dustproof motors are designed for maximum heat flow. Some of the design features include adjustable louvers, guard screens, defroster booster motors, damper control knobs and accessible fans.

Manufacturer—Young Radiator Co., 709 S. Marquette St., Racine, Wis.

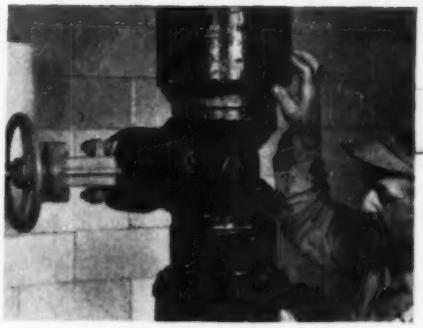
Pipe Threader

"Ridgid '504' " pipe threader for use on power drives. . . . According to the manufacturer, the threader is self-contained and can be adjusted to thread 1-in. to 2-in. pipe using one set of dies. The "quick-opening" handle is designed to retract dies without stopping the power drive. Dies can be adjusted without removing the threader from the machine. The threader will fit all standard power drives. Other features include one set of steel dies and a pre-set four-jaw centering guide. It will cut oversize, undersize and extra long threads.

Manufacturer—The Ridge Tool Co., Clark St., Elyria, Ohio.

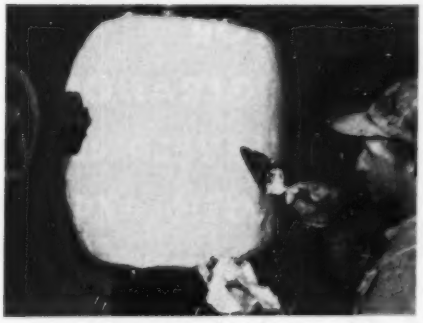
[*Continued on page* 190]

New material simplifies insulation of cold lines

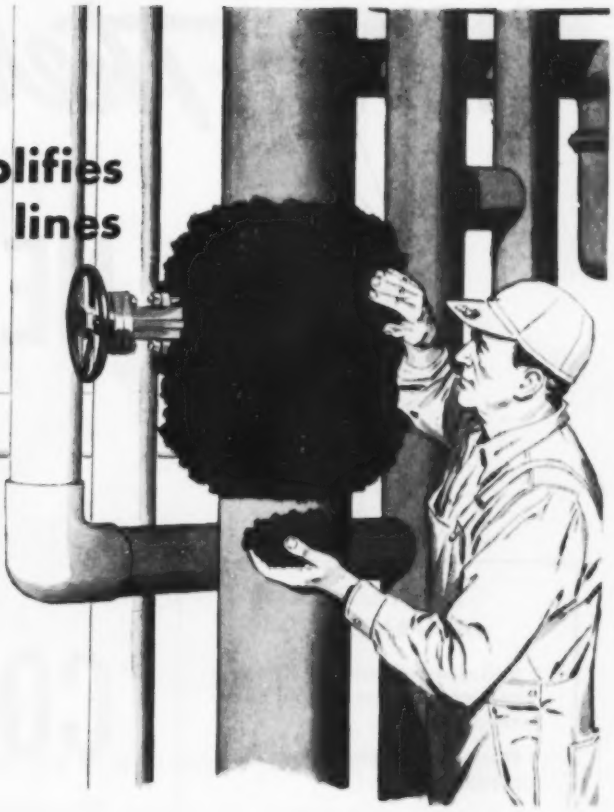


1. Prime fitting with Plasticork Primer . . . when dry, pack Plasticork firmly into voids.

2. Build Armstrong's Plasticork to required thickness and hold in place with twine.



3. Apply Keene's Cement, Weatherproof Plastic, and No. 1 Cork Covering Paint.



Armstrong's Plasticork can be used on any cold line fitting

Cutting standard molded covers to fit in close quarters or over nested fittings is a time-consuming task. Building covers on the job for these hard-to-insulate places is slow and expensive. Waiting for molded covers for special fittings to be made up and shipped to the job site can also delay the work. Plasticork* eliminates all these problems. With Plasticork on hand, the workman builds the fitting cover as he goes, does a speedy and efficient job.

Plasticork is a new, moldable granulated cork-and-rubber cold line insulation. The workman actually molds it to the proper size and thickness, shaping it by hand to the fitting he is insulating. In some applications, Plasticork may entirely eliminate the use of regular molded fitting covers. In others, it will supplement them.

Plasticork can be held in stock for years without losing its moldable characteristics. This means it can also be removed from a fitting and used over again without loss of insulating efficiency or workability.

A stock of Armstrong's Plasticork in your warehouse or storage room will allow you to have on hand at all times the material necessary to insulate any fitting. For a free booklet fully describing Armstrong's Plasticork and its use, call your nearest Armstrong office or write Armstrong Cork Company, 2110 Sherman Street, Lancaster, Pennsylvania.

* T.M. Reg. applied for

ARMSTRONG'S INDUSTRIAL INSULATIONS

For temperatures from 300° below zero to 2800° F.

NOW... *Thermaflex:*

SPECIALLY DESIGNED

NEW FLEXIBLE DUCTING FOR AIR CONDITIONING!

THERMAFLEX ADVANTAGES

- Makes simplified connections between diffuser—sound box—main duct
- Eliminates misalignment problems
- Takes bends up to 180°
- No worry about obstructions
- Quickly, easily installed
- No special fittings
- Deadens noises in line
- Excellent air flow characteristics

Thermaflex is the sensational new development in air conditioning ducting... proved in large scale installations by leading manufacturers of air conditioning equipment... perfected by engineers with widest experience in flexible ducting.

Thermaflex saves *time, money* and *labor* in air conditioning installations because it's *lightweight, flexible.* And it's rugged too! Find out how *you* can save with Thermaflex!

THERMAFLEX WILL BE ON DISPLAY FOR THE FIRST TIME ANYWHERE AT THE REFRIGERATION AND AIR CONDITIONING EXPOSITION—CLEVELAND, NOVEMBER 9-12. VISIT OUR EXHIBIT—BOOTH #748

Manufacturers Representatives:
We have territories available on exclusive franchise—See us at Exposition or write for details.

Flexible Tubing

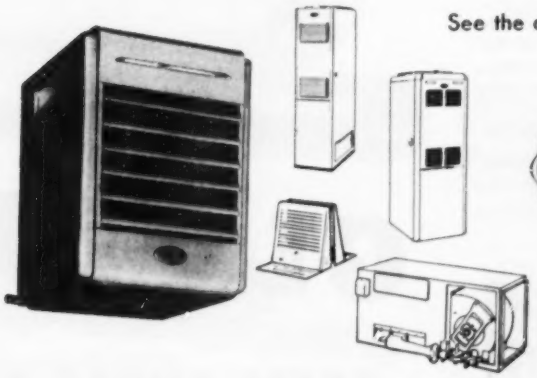
CORPORATION
Guilford, Connecticut • Pasadena 1, California

a new high in heat efficiency

UTILITY'S MODEL 50 UF UNIT HEATERS

Here is the perfect answer to problem situations where high heating power is demanded, but where the heating unit must be both compact and attractive. Only 23 inches high, Utility's Model 50 UF Unit Heater can be fitted into the smallest areas...yet it delivers 50,000 BTU.

Its low 24-voltage control makes quick and economical installations possible by eliminating the necessity for line voltage thermostat leads. Ceramic coated heat exchanger, built-in fully automatic fan control; and summer switch provides air circulation for warm weather ventilation. Designed to become an attractive addition to any store or office, Utility's Model 50 UF Unit Heater is the perfect choice for efficiency, ease of installation, low cost, and freedom from service problems. AGA-approved.



See the complete UTILITY heating line now

UTILITY APPLIANCE CORP.
4851 S. Alameda St., Los Angeles 58, Calif.

MANUFACTURERS OF GAFFERS & SATTLER AND OCCIDENTAL AUTOMATIC GAS RANGES • UTILITY AUTOMATIC GAS HEATING EQUIPMENT • UTILITY AUTOMATIC GAS WATER HEATERS • UTILITY AIR COOLERS AND BLOWERS

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Please send me free information on:

☐ Utility Automatic Heating Equipment
☐ Utility Cooling Equipment
☐ Utility Automatic Gas Water Heaters

Name_____

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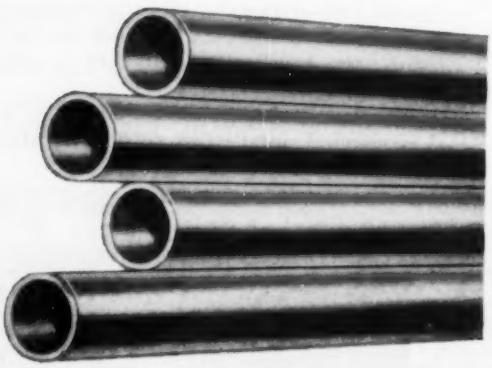
You're sure of UNIFORM HIGH QUALITY

SEAMLESS • PRESSURE • MECHANICAL

CARBON STEEL TUBES

when you specify GLOBE



SIZE RANGE — WALL THICKNESS

Globe seamless carbon steel tubes are available in a size range of ½ inch to 7½ inches O.D.; wall thickness of .028 to 1.000 inch.

APPLICATIONS

Globe Pressure Tubes are used for boilers, condensers, heat exchangers and process equipment. They meet most exacting demands of modern high pressure and high temperature installations. Globe Mechanical Tubing (seamless) is produced by piercing solid billets. It is an ideal material for low-bearing structural members and parts where strength with minimum weight is needed. Its economy for the manufacturing of many machine parts is universally recognized.

Globe seamless carbon steel tubes are furnished to standard specifications in low and medium carbon ranges.

WHEN you specify Globe you are sure of uniform high quality carbon steel tubes. That's because they are the product of highly developed production facilities and specialized quality controls and methods.

Globe engineers are at your service to assist in the selection of tubing of the exact characteristics you require.

GLOBE TUBES

GLOBE

STEEL TUBES CO.

MILWAUKEE 46, WISCONSIN

Chicago • Cleveland • Philadelphia • St. Louis • New York • Detroit • Denver • Houston • San Francisco
Glendale, Calif.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — alloy-carbon seamless steel tubes — Globeiron (high purity ingot-iron) seamless tubes — Globe welding fittings.

a blue-chip investment that pays

"DIVIDENDS UNLIMITED"

NEW *Ramset* PLUS-POWER JOBMASTER

for super-speed fastening into steel and concrete

For quick, continuing profits on a small investment, look into this latest RAMSET development in powder-actuated fastening. The PLUS-POWER JOBMASTER has already gained "top ratings" from its many enthusiastic users. It greatly extends the profitable use of powder-actuated fastening, to earn substantial savings in time, money and work. For instance:

Saves ⅓ cost of powder charges—using lower-priced, light-duty charges, you can set most RAMSET Tru-Set studs and drive pins which formerly called for high-cost, heavy-duty charges.

Set new ⅜" Flat Head Drive Pins—these cost considerably less than comparable heavy-duty fasteners, yet are equally effective for anchoring exterior and interior framework to concrete slabs, and other wood-fastening applications—without using a disc.

Combines 2 tools in 1—with the same basic tool, you can use either a ⅜" or a ¼" barrel, changing from one to the other in a few seconds. If you now own a standard JOBMASTER, let us convert it to this double duty at a nominal cost.

For six years, thousands of users have proved that high-speed, low-cost RAMSET SYSTEM pays "dividends unlimited" for fastening into steel and concrete.

Investigate—On every count, the PLUS-POWER JOBMASTER pays continuing "dividends unlimited". We suggest you investigate. Call your dealer or mail the coupon for on-your-job demonstration of how you can save time, money and work with RAMSET—the first powder-actuated fastening SYSTEM.

Ramset Fasteners, INC. ANOTHER Olin PRODUCT

Ramset Division, Olin Industries, Inc.

12109 BEREA ROAD • CLEVELAND 11, OHIO

Please send more details on PLUS-POWER JOBMASTER, the Blue-Chip investment for steel and concrete fastenings.

Name_____

Company_____

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City_____

HP-10

INDUCED DRAFT SYSTEMS *need* SELECTED STARTING DRAFT!

A Draft Inducer is designed to provide a constant draft supply for maximum stack requirements. Without proper controls, it delivers maximum draft at all times. But under some conditions, this maximum draft needs correction—in particular during initial light off, whether on low-fire start, "high-low" burners or modulating burners, where excessive draft often causes starting failure or re-cycling.

CLEVELAND DAMPER CONTROL

***provides the* 4 CONTROL FEATURES *essential to safe efficient operation of* INDUCED DRAFT SYSTEMS**

1. **STARTING DRAFT SELECTOR**—providing pre-determined optimum draft for smooth, safe, ignition. When ignition is completed, damper control goes to full, automatic draft regulation.
2. **AUTOMATIC DRAFT MODULATION**—maintaining ideal draft for proper combustion under varying firing rates and stack conditions.
3. **AUTOMATIC SEQUENCE OPERATION**—providing proper draft for all phases of firing cycle, with proper shut-off of draft during "off" periods.
4. **LOW DRAFT CUT-OFF**—providing the safety of an integral minimum draft switch that shuts down firing at unsafe low draft limits. Time-delay feature prevents nuisance shut-downs due to momentary puffs.

Only CLEVELAND DAMPER CONTROL can give ALL 4!

Write for complete information.

The CFE line includes damper controls, steam controls, electronic smoke detector control units, draft, air pressure and flue temperature gages.

COMBUSTION INSTRUMENTS & CONTROLS — CLEVELAND FUEL EQUIPMENT CO. — FOR EFFICIENCY AND ECONOMY

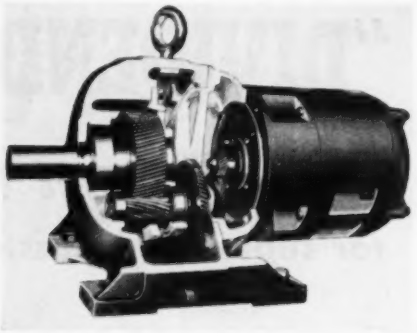
CLEVELAND FUEL EQUIPMENT COMPANY

1111 Brookpark Road, Cleveland, Ohio

[*Continued from page* 184]

Integral Gearmotors

New integral gearmotor series from 1 to 15 hp. . . . The motors are offered in a wide range of speeds, in single, double and triple gear reductions, and can be had to fit varying load requirements. Motors are

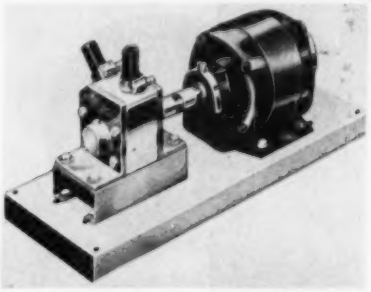


available with constant or variable speeds and with protective frames to operate under most atmospheric conditions.

Manufacturer—Century Electric Co., 1806 Pine St., St. Louis 3, Mo.

Gas Sampling Pump

Gas sampling pump for use in conjunction with gas analyzing equipment. . . . The pump utilizes an eccentric shaft and rotor assembly which rotates inside and actuates a molded flexible liner, the "Flex-i-liner." The gas which is trapped on the outer surface of the liner and the inner surface of the body block is "squeezed" through the pump. Molded flanges on the liner are



pressed to both sides of the body block by end plates, sealing off the fluid passage from contact with moving parts. The body block and liner are made of corrosion resistant materials. Where continuous operation is required and where relatively high vacuums and discharge pressures are specified, a reservoir can be placed directly above the discharge in the discharge line. The reservoir can be filled with either water, oil, or any fluid which will not affect the gas sample.

Manufacturer—Vanton Pump Corp., Empire State Bldg., New York 1.

Pilot Relay for Flow Meters

"Differential Converter" unit incorporating a pilot relay transmitter to reduce air consumption to a minimum. . . . The unit is designed to convert the differential pressure of flow into air pressure, transmitting

For Hot Water Heating Sales . . .

BASE-RAY IS THE CLINCHER!

7 CLINCHERS FOR BASE-RAY SALES!

1. BASE-RAY* is the outstanding way to provide your customers with the Magic of Radiant Hot Water Heating. They're quick to grasp the fact that it's "like heating your home with the sun."

2. BASE-RAY gives maximum personal comfort, blankets outside walls and windows with a shield of heated air — an effective guard against cold infiltration. Floor-to-ceiling temperatures practically constant, even in coldest weather. No cold feet and no cold corners.

3. A BASE-RAY system with a sturdy cast-iron Burnham Boiler costs little more than a forced air system . . . only a dollar or two added to monthly payments carries the difference. And value-wise there's just no comparison!

4. BASE-RAY'S rugged cast-iron construction withstands hardest knocks, will not dent, resists corrosion for a lifetime, provides real long range economy.

5. BASE-RAY with its low sweeping lines fits inconspicuously into any room. Saves space, promotes smart, uncluttered interior decor . . . can be painted to blend with any color scheme.

6. BASE-RAY delivers true radiant heat. Since there are no false fronts or grilles the warm surface of BASE-RAY is exposed directly to the room, thus giving unobstructed radiant heat.

7. BASE-RAY is fully waterbacked. This, plus the excellent heat retaining properties of cast iron, means BASE-RAY continues to deliver radiant heat long after the burner shuts off.

And to top off these many advantages, BASE-RAY offers a unique low cost installation procedure called the "series loop" system, making big savings possible. Readily installed in new or modernization jobs.

*Reg. U. S. Pat.Off.

Cross section showing how BASE-RAY is filled with water from top to bottom.

BURNHAM BASE-RAY RADIANT BASEBOARD

BURNHAM BASE-RAY WEARS LIKE IRON . . . BECAUSE IT'S MADE OF IRON

Burnham Corporation

BOILER DIVISION IRVINGTON, NEW YORK

FIRST IN THE MANUFACTURE OF BASEBOARD HEATING

Burnham Corporation HP-103
Irvington, New York

Please send me full information and ratings guide on BASE-RAY

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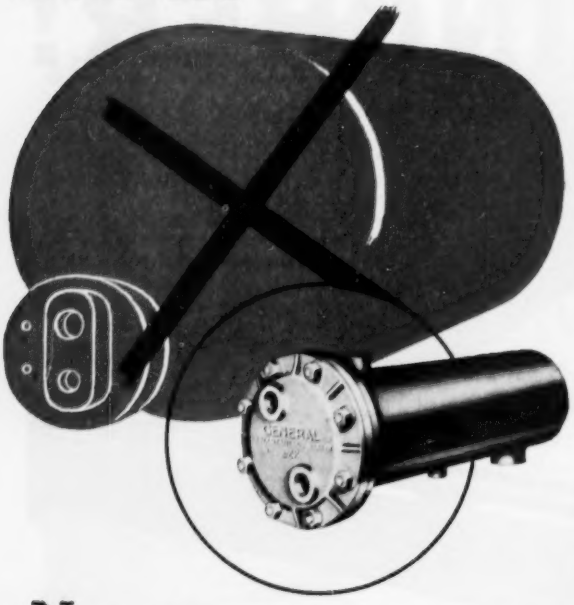
Heat Water the Modern Way ...without a tank



NOW YOU CAN HAVE a continuous hot water supply without installing a bulky storage system. General Instantaneous Water Heaters supply hot water as it is needed, and require a minimum of space. The largest model delivers 300 gpm and measures less than 2 ft. x 7 ft.

Installation is simple . . . whether on the floor or overhead. Merely tap the General Instantaneous Heater into your service line and connect a live or exhaust steam supply for heat source. Periodic maintenance is eliminated. Seamless copper tubing and bronze head and tube plates assure years of "clean" hot water supply.

You'll find a model to fit your needs among 21 sizes of General Instantaneous Water Heaters. Write for Catalog 60. General Fittings Co., Dept. A, 123 Georgia Ave., Providence 5, R. I.

GENERAL

INSTANTANEOUS WATER HEATERS

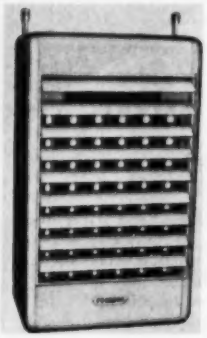
this through tubing to indicating, recording or controlling instruments. According to the manufacturer, the converter uses one-sixth as much air as nozzle-pressure transmitters. Meter bodies are said to be capable of standing process fluid temperatures up to 350 F, and the transmitter up to 225 F.

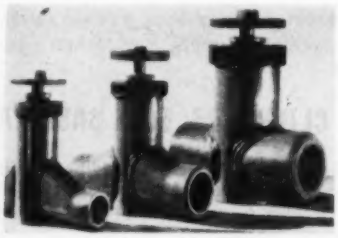
Manufacturer—Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne & Windrim Aves., Philadelphia 44.

Needle and Globe Valves

**Needle and globe valves made of "Boltaron 6200" unplasticized polyvinyl-chloride for use with pipe and fittings of the same material. . . . The valves are available in sizes ⅛ in. through 2 in. According to the company, complete piping systems can now be installed to handle corrosive liquids. The material is said to be non-toxic, may be drawn, formed, molded, machined and welded by the hot air method.

Manufacturer—H. N. Hartwell and Son, Inc., 31 St. James Ave., Boston.





Above: Valves

Left: Heater

Gas Fired Unit Heater

New line of gas fired unit heaters made in eight sizes. . . . These new models are designed to provide a compact self-contained unit housing burner, heat exchanger, fan and automatic controls, all in one cabinet. According to the manufacturer, all that is necessary for operation is to connect the gas supply line, hook up electric supply and provide a vent. Capacities range from 55,000 to 200,000 Btu per hr.

Manufacturer—Fedders-Quigan Corp., Heating Div., Hancock & Lalor Sts., Trenton 7, N. J.

Indoor-Outdoor Temperature Controller

"Weatherbrain" indoor-outdoor control . . . . It is a thermostatic water mixing valve which delivers water to radiators or panels at the right temperature to overcome the heat loss of the building. Mixed water temperature is governed by an outside bulb. The indoor-outdoor temperature ratios and the actuating power elements are interchangeable. The company states that no adjustment is required after the initial installation.

Manufacturer—Detroit Controls Corp., 5900 Trumball Ave., Detroit 8.

Pipe Machine

No. 784, "Thrift Model" 4-in. pipe machine. . . . Floor type pipe machine has a standard range of 1 to 4 in. and extra range of ½ and ¾ in. It is equipped with a front chuck which requires no wrench

HEATING PUMPS

To always meet

ALL REQUIREMENTS

CHICAGO INDUSTRIAL PUMPS

Chicago's complete line of heating pumps are designed to meet the specific and exacting needs of building service. When you specify Chicago Heating Pumps you can be certain you will always get the correct pump for the job.

You can get the complete data on any or all series of Chicago Heating Pumps simply by writing for the technical Bulletin referred to under each type. This information is truly complete—includes engineering, specification and dimension data, as well as performance records, charts and tables.

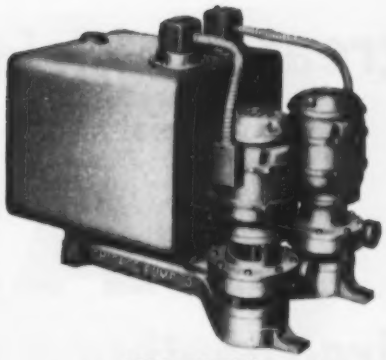
CHICAGO PUMP COMPANY

BUILDING and INDUSTRIAL DIVISION

622 DIVERSEY PARKWAY — **CHICAGO 14, ILLINOIS**

Condo-Vac, Sure Return, AVC, LVC, Fire, House & Circulating Pumps
Pneumatic & Tankless Water Systems.

Flush-Kleen Sewage Ejectors
Little Giant & Non-Clog Bilge Pumps
Pumps for every industrial use.

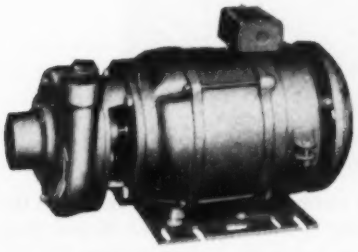


SURE RETURN CONDENSATION PUMP & RECEIVER

For systems up to 75,000 EDR and for low and medium pressures. Available in either single or duplex units. The base serves as a large capacity manifold through which the condensate flows by gravity from the receiver to the pump. The Sure Return will not steam bind. Described in Bulletin 250.

TYPE CLLI VERTICAL CONDENSATION PUMP & RECEIVER

Specifically designed for low return service and underground installations. Flanges are accurately finished and gasketed to prevent steam leaks. Pump and receiver are shipped as a unit, ready to install. For 1000 to 40,000 EDR and 10 to 25 lbs. pressure. Described in Bulletin 255.

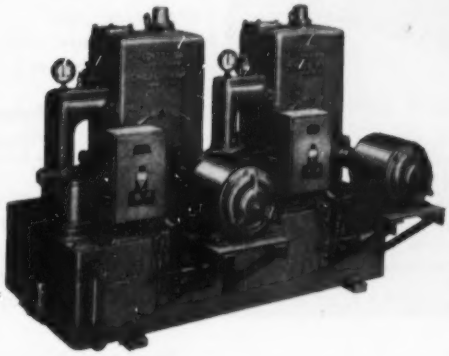


C-C CLOSE-COUPLED SERIES PUMPS

C-C Series Pumps combine pump and motor in a single compact unit for easy installation, eliminating coupling and alignment problems, and are equipped with the leak-proof CHICAGO mechanical seal. Each pump operates over the entire range of its curve without motor over-load.

DUPLEX CONDO-VAC RETURN LINE VACUUM AND BOILER FEED PUMP

Specifically designed for vacuum heating systems. The water capacity of the Condo-Vac remains constant up to the boiling point. The air capacity remains constant to the evaporation point. Pressures up to 40 lbs. Capacities from 2500 to 150,000 EDR. Described in Bulletin 270.



TYPE AVC CONDENSATION PUMP & RECEIVER

Heavy cast iron receiver with low inlet for floor mounting or shallow pit. Sets on floor—no foundation bolts necessary. Weight of unit and piping hold unit firmly in place. For 500 to 10,000 EDR and 10 to 30 lbs. pressure. See Bulletin 245.

greater efficiency for

Commercial and Industrial

GAS

fired heating plants with

field

"M-G" draft controls

1. Double acting gate opens inward to regulate up-drafts and outward to relieve down-drafts.
2. Adding or taking off weights provide simple adjustment for up-draft conditions at time of installation.
3. Control will relieve internal or down-draft pressures of only a few thousandths of an inch.
4. Weights attached to gate itself are factory set to insure extreme sensitivity to down-draft conditions.
5. Corrosion resistant knife edge bearings resting on self-aligning bearing plates assure extreme sensitivity yet long life.
6. Side wings improve the regulation, making the control accurate at all gate positions.
7. Long collar keeps gate out of the path of flue gases—resulting in greatly increased life.

Now there is a Field Draft Control to provide for commercial gas-fired heating plants the same accurate, dependable, fuel-saving performance that has made Field first choice for oil and coal furnaces. The new Field "M-G" for gas is fully proven, widely accepted, fully safe — a control specially designed for gas but retaining all outstanding design features of the Field Type M Control. Write today for complete information.

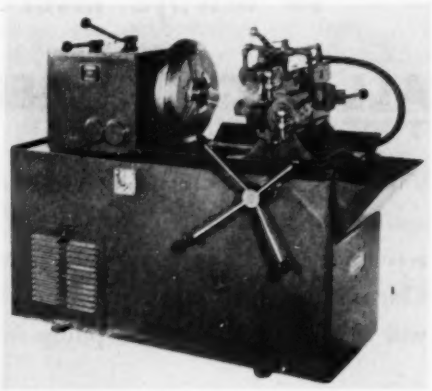
FIELD CONTROL DIVISION

of H. D. Conkey & Company — Mendota, Illinois

AFFILIATES: Conco Building Products, Inc. — Brick, Tile, Stone
Conco Materials Handling Division, — Cranes, Hoists

UP-DRAFT VIEW
Gate opens inward to regulate updrafts in conventional, proven manner, checking any excess in draft.
DOWN-DRAFT VIEW
Gate opens outward to relieve down drafts which might affect flame. An optional safety switch closes main gas valve in case of prolonged down draft, thus providing full protection.

for operation. According to the manufacturer, it is suitable for frequent changes of pipe sizes because the hand wheel moves the gripping jaws through the entire range in a few seconds. A magnetic starter with push-pull selector switch for run and jog controls the 1800 rpm,



3 hp motor. This model has four spindle speeds. Two detachable lever operated die-heads cover the pipe and bolt range and are adjustable for over-or under-size threads. Dies are of the hobbed type. There are five segments to each set of dies.

Manufacturer—The Oster Mfg. Co., 2057 E. 61st Pl., Cleveland 3.

Evaporator Coil Assembly

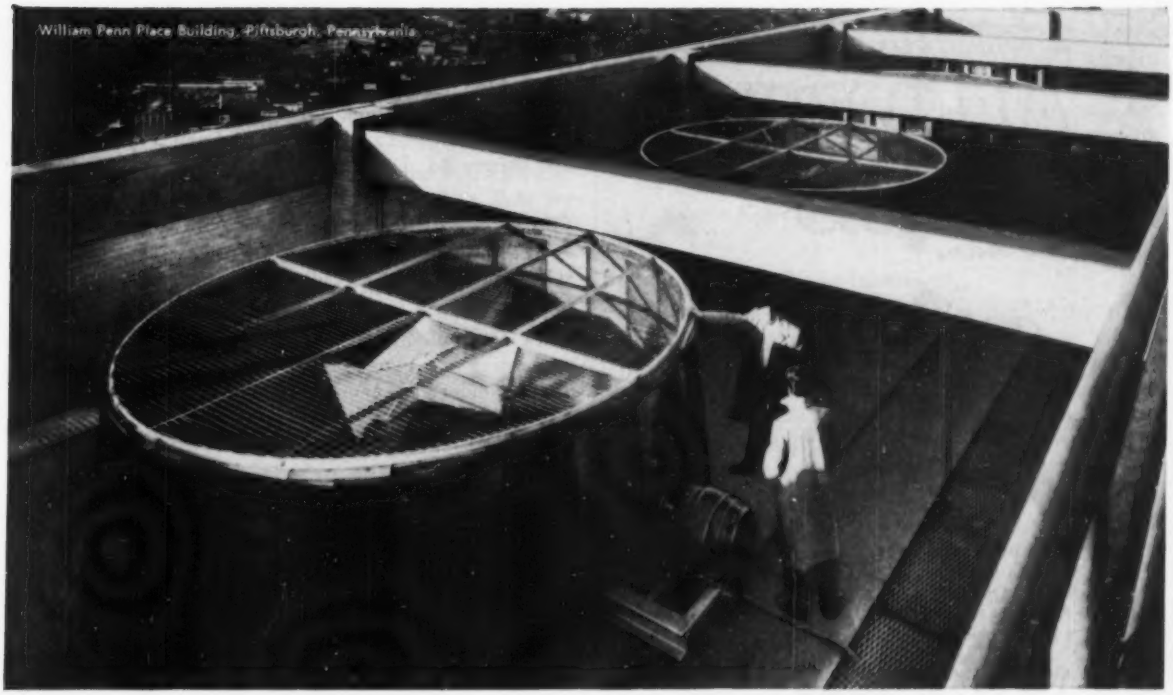
Prefabricated evaporator coil assembly to speed installation of the manufacturer's 2 and 3 hp air and water-cooled air conditioning systems. . . . The evaporator coil is encased in a 21-gage steel wrapper. Removable side panels permit either horizontal or vertical

installation in forced warm air ducts. According to the company, the assembly eliminates much on-the-job time and labor required to fabricate a duct section for the evaporator coil.

Manufacturer—Chrysler Corp., Airtemp Div., 1600 Webster Ave., Dayton 1, Ohio.

Heating Calculator

Direct reading heating calculator for figuring heat loss . . . . The pocket-size calculator, which requires no interpolation, operates like a slide rule giving the Btu for any area or volume under a choice of 28 factors. Either the area or volume is set in the window under the arrow, and on the same line under the desired "U" factor, the Btu is read directly. On the face of the



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. . . demand the best! That's why they depend on Pritchard for the proper solution to comfort cooling problems. For 28 years, Pritchard has demonstrated its exceptional qualifications to coordinate architectural treatment, mechanical equipment, engineering skill and modern construction methods into outstanding cooling tower installations.

Pritchard is a founder member of the Cooling Tower Institute . . . has the long experience necessary to assist you in selecting the *right* tower for your client's needs, the proved ability to design and construct the tower that will meet their operating requirements. You can be absolutely certain of that because Pritchard *unconditionally guarantees* the performance of its towers. Economical, efficient operation is assured because Pritchard towers are thoroughly engineered for adequate capacity and will conserve up to 99% of the water for re-use.

For complete information, contact your nearby Pritchard representative listed in the classified section of your telephone directory, or write direct to Pritchard's General Offices, Kansas City, Mo.

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Cooling Towers
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Representatives in Principal Cities from Coast to Coast

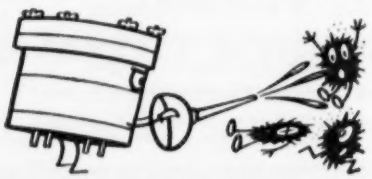
As advertised in TIME, NEWSWEEK and BUSINESS WEEK

AIR-MAZING FACTS

BY O. SOGLOW

DUST DEADLY AS BACTERIA. Certain types of dust are extremely harmful to human beings. Quartz dust, for example, can sometimes lead to diseases such as silicosis, cancer and tuberculosis.

TRAPS DUST! Air-Maze air filter panels keep troublesome dust out of hotels, railroad cars, commercial and industrial buildings. Cleaning bills are cut, employees and customers are happier. Air-Maze filter panels are easily cleaned, have high dirt-holding capacity.



STOPS DUST WITH OIL! Air-Maze oil bath filters literally "scrub" intake air in a pool of oil. Used on large diesel engines and air compressors, they keep damaging dust and dirt from moving parts.

WHETHER YOU BUILD OR USE engines, compressors, air-conditioning or ventilating equipment, *or any device using air or liquids* —the chances are there is an Air-Maze filter *engineered* to serve you better. Representatives in all principal cities. For condensed product catalog write Air-Maze Corporation, Cleveland 28, Ohio.

AIR-MAZE

The Filter Engineers

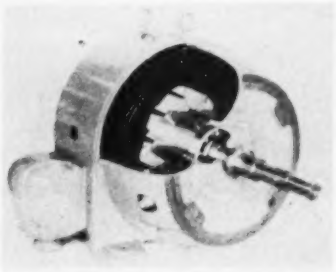
AIR FILTERS
SILENCERS
SPARK ARRESTERS
LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

calculator an example is worked out to demonstrate its use. Along the edges there are five different scales and a table of the more commonly used heat loss "U" factors for all types of construction.

Manufacturer—Paul S. Morton Engineering Services, 609 Bangor Rd., Lawrence, Mich.

Close-Coupled Pump Motor

Close-coupled pump motors now available up to 60 hp. . . . Designed specifically for use with centrifugal pumps, this motor, type "SCB", reportedly eliminates shaft alignment or pump mounting problems by supporting the pump on its mounting bracket. A step shaft, shoulder and tapped hole for mounting the impeller,



has ground diameters for sealing against leakage. Grease lubricated ball bearings are designed to permit vertical, horizontal or intermediate angle installation. A solid closed flange on the style "C" adaptor bracket prevents entrance of the pumped liquid into the motor, the manufacturer states.

Manufacturer—U. S. Electrical Motors, Inc., Box 2058, Terminal Annex, Los Angeles 54.

EQUIPMENT BRIEFS . . .

SEALING DEVICE for sealing of bolts and studs at either high or low pressure, gas, liquids or air . . . . Known as "Stat-O-Seal," it uses the principle of controlled confinement of the sealing gland. It is a one piece construction and non-directional. It cannot be assembled upside down. The "O" ring sealing gland is mechanically fastened to the metal retainer.

Manufacturer—Franklin C. Wolfe Co., 3644 Eastham Dr., Culver City, Calif.

GREASE-FITTING COVER to keep dirt and other abrasives from entering grease fittings . . . . "Zur-Kap" is made of oil-resistant neoprene and is designed for use on equipment using Zerk or Alemite-type fittings.

Manufacturer—Winner Mfg. Co., Box 945, Fort Wayne 1, Ind.

AUTOMATIC THROTTLE REGULATOR for fuel oil truck pumping . . . . Installed under the engine hood in the vicinity of the carburetor, the throttle automatically adjusts the engine speed, when power take-off is engaged, to the proper rpm for maximum efficiency of the pump. When power take-off is disengaged, the engine speed returns to normal traffic idling speed.

Manufacturer—Scully Signal Co., 88 First St., Cambridge 41, Mass.

RECENT TRADE LITERATURE . .

Air Conditioning Coils

Bulletin No. 103-53 illustrates and describes "AC4" coils, standard 4-row air conditioning coils. Included in the bulletin is information on coil construction, application data and prices. Application data for 11 models includes model number, nominal tons capacity, dimensions, face area in square feet and recommended air flow in cubic feet per minute. Engineering drawings complement the tabular material. Also covered are the four styles, for different air flows, in which the coils are available.

Manufacturer—Tenney Engineering, Inc., 26 Avenue B, Newark 5, N.J.

Air Cooled Heat Exchangers

The use of air-cooled heat exchangers for a variety of industrial cooling and condensing applications is described in this illustrated bulletin. Known as "Fin-Fan" heat exchangers, the units described are of the forced draft type and are designed to cool liquids or gases at pressures up to 5000 psi and temperatures up to 1500 F. The bulletin contains descriptions of design and construction, operating diagrams and a chart of typical applications.

Manufacturer—Fluor Corp., Ltd., 2500 S. Atlantic Blvd., Los Angeles 22.

Belt-Center Calculator

A calculator in graph form gives information for belt-center selection for fans and compressors, determination of horizontal distances between shaft centers, and checking equipment clearances. According to the company, it is accurate to 1/8 in. On the reverse side of the calculator sheet a fan engineering data sheet gives NAFM and NEMA data. Also included are standard nomenclature for fan width and an explanation of fan class.

Publisher—Korfund Co., Inc., 32nd Place, Long Island City 1, N.Y.

Bonding for Metal Surfaces

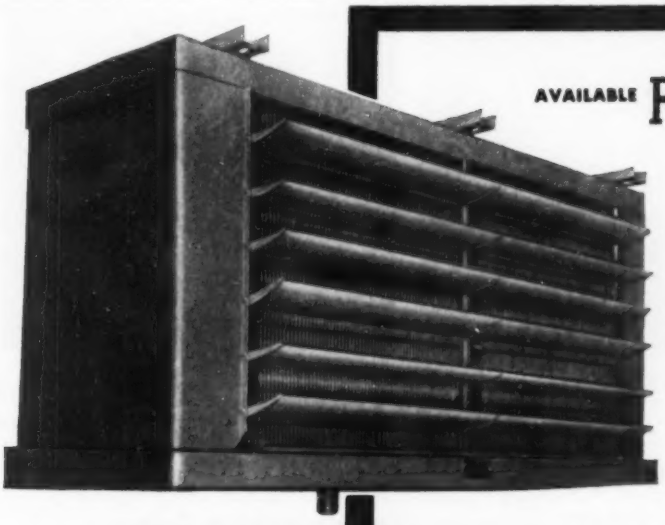
Pamphlet A-108 describes the "Turcoat" phosphate compounds used for coating various types of organic finishing. The bulletin includes a phosphating reference chart which outlines the purposes of phosphate coatings, government specifications, recommended uses, methods of application, equipment required, metals which can be treated, coating weights in mg/sq ft and operation cycle.

Manufacturer—Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Calif.

Boiler for Oil or Gas Firing

Catalog 98 illustrates and describes the "M-800" series boilers for high and low pressures and designed for oil or gas firing. The catalog contains listings of ratings, dimensions, standard equipment and trim. According to the company, the boiler may be used with any oil, gas or combination oil-gas burner to form a complete boiler-burner unit.

Manufacturer—Kewanee-Ross Corp., 101 Franklin St., Kewanee, Ill.



RIGIDBILT LARGE CAPACITY UNIT COOLERS

• REDUCES NUMBER OF UNITS REQUIRED • REDUCES PIPING AND ELECTRICAL CONNECTIONS • FOR STANDARD OR LOW TEMPERATURES (WITH WATER DEFROST) • EFFICIENT • ECONOMICAL

FAST DELIVERY!

AVAILABLE RIGIDBILT PRODUCTS

- CEILING TYPE AIR CONDITIONING UNITS
- FLOOR TYPE AIR CONDITIONING UNITS
- VENTILATING UNITS
- DIRECT EXPANSION COOLING COILS
- WATER COOLING COILS
- STANDARD STEAM HEATING COILS
- STEAM DISTRIBUTING TUBE HEATING COILS
- HOT WATER HEATING COILS
- SUSPENDED TYPE UNIT COOLERS FOR ALL REFRIGERANTS
- FLOOR TYPE PRODUCT COOLERS
- SPECIAL COILS FOR ALL REFRIGERANTS

DESIGNED TO MEET THE MOST EXACTING REQUIREMENTS

RIGIDBILT IS BETTER BUILT—Write for Catalog.

RIGIDBILT INC.

2852 W. FULTON ST. CHICAGO 12, ILLINOIS

Bronze Gate Valves

Two illustrated circulars graphically describe the company line of 150 and 200-lb S. P. bronze gate valves. The circulars, complete with dimensions, describe the advantages of flange and screw gate valves equipped with either double or solid nickel-alloy wedge discs in rising stem designs and with a single wedge disc in non-rising stem types.

Manufacturer—The Lunkenheimer Co., Box 360, Cincinnati 14, Ohio.

Corrugated Expansion Joints

Illustrated eight-page catalog No. 133 describes the "Flexon" line of expansion joints and presents data for the proper selection and application of pipeline expansion joints. Included is a discussion of types of pipeline motion encountered and methods of handling this motion. Also covered are complete specifications for low and high pressure units and detailed information on special types of joints. Another section deals with the proper guiding and anchoring of expansion joint installations.

Manufacturer—Flexonics Corp., 1391 S. Third St., Maywood, Ill.

Diffusers, Registers and Grilles

New catalog describes the manufacturer's line of diffusers, registers and grilles for winter heating and summer cooling. Included are photographs and drawings of air diffusion patterns, engineering data, performance charts and specifications. New products illustrated include the "45" wall diffuser for perimeter heating where side wall or extended baseboard installations are preferred and the "Wall-O-Way" stackhead and frame for out-of-the-wall installations in old or solid wall construction.

Manufacturer—The Lima Register Co., 651 N. Baxter St., Lima, Ohio.

Dust in Metal Working

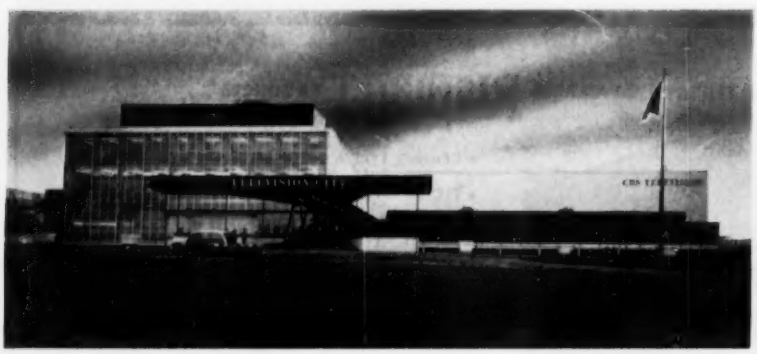
How dust can be controlled in metalworking industries is discussed in Bulletin 392. Special attention is given to the use of high-efficiency cloth-tube-type dust collectors in the ventilation of grinding and annealing operations, sprue mills, and blast cleaning equipment. A section is also devoted to the role of cloth filtration in such hot operations as the collection of foundry cupola fume. Another section discusses the importance of product recovery.

Manufacturer—American Wheelabrator & Equipment Corp., 1321 S. Byrkit St., Mishawaka, Ind.

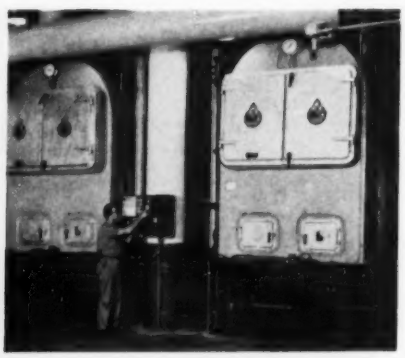
Electric Circulation Heaters

Typical applications and operating characteristics of "Chromalox" electric circulation heaters are featured in Bulletin 701. The folder explains how the heaters are designed to give automatically controlled heating of water, steam, oil, heat transfer media, air and other gases for industrial processes. Photos and drawings show methods of installation and the advantages of the packaged units for a wide variety of installations.

Manufacturer—Edwin L. Wiegand Co., 7610 Thomas Blvd., Pittsburgh 8.



Photos by Ezra Stoller — The World's Largest Television Plant.
Architects—Pereira and Luckman. *Plumbing and Heating Contractor*—E. Willardson.



Two National Commercial Steel Boilers—combination gas and oil-fired. With an output of 8,743,000 BTU each, the boilers generate a total of 30 lbs. of steam.

IN CBS TELEVISION CITY . . . TWO NATIONAL Boilers use TWO fuels each, do TWO separate heating jobs

Two National Commercial Steel Boilers, in a most unusual installation, are now in operation in the multi-million dollar CBS Television City in Los Angeles, Calif.

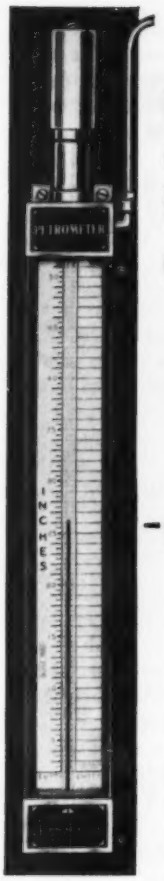
Both National Boilers are combination oil and gas-fired. They supply steam to 15 banks of copper coils in the heating portion of the building's unique air-conditioning-heating system and also to two heat exchangers for supplying domestic hot water. Installed in tandem, one boiler can handle the steam load, if necessary. CBS Television City, with its four giant studios, makes extraordinary demands upon air-conditioning and heating; proper temperatures and atmospheric conditions must be maintained under hot lights and no noise from the system is permitted to penetrate to sound stages.

THE NATIONAL RADIATOR COMPANY, JOHNSTOWN, PENNSYLVANIA

For full details on National Commercial Steel Boilers write for Bulletin 507A-10-HP

For Real Heating Comfort go NATIONAL

Branch Offices: Baltimore • Boston • Buffalo • Chicago • Cleveland • Detroit • New York • Philadelphia • Pittsburgh • Richmond • San Francisco • Washington, D. C.



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REMOTE READING
LIQUID DEPTH GAUGES

"Bring Your Liquid Level to Eye Level"

THE BEST GAUGE FOR:

Commercial and Industrial Fuel Oil Storage Tanks

Domestic Installations with Buried Tanks

Storage Tanks for other Industrial Liquids—gasoline, solvents, acids, etc.

HERE'S WHY:

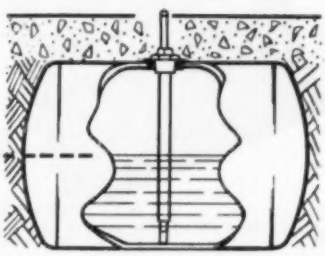
Can be installed on tanks above or below the ground and up to ¼ of a mile away.

No troublesome moving parts—operates on the principle of the U-tube. Simple, dependable and accurate.

Large, easy-to-read vertical scale gives tank contents at a glance. Scales are easily changed for different liquids.

Easy to install—the tank assembly for the gauge can be installed when the tank is empty or when containing liquid. It can also be installed separately to complete the tank work. The gauge can be connected any time later. Only one simple connection to tighten.

WRITE FOR BULLETIN PH *TODAY.*



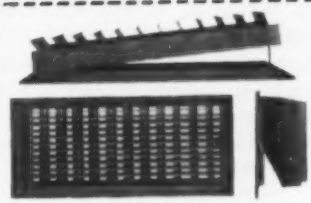
FOR TANKS 20 INCHES TO 50 FEET DEEP.

LIQUIDEPTH INDICATORS, INC.
43-22 TENTH STREET
LONG ISLAND CITY 1, N. Y. 4

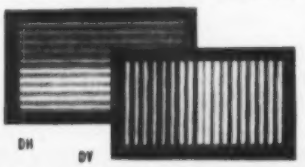
when in the dark... Look to Stewart
for Outstanding New Advances in Air Conditioning Outlets

In this Complete Catalog . . .

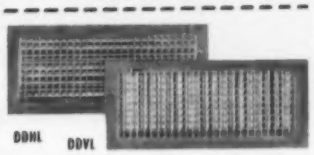
For Quality, Originality, Economy and Fast Delivery—your best choice is Stewart for Industrial and Commercial Registers — Grilles and Air Controls. You'll find one to suit your every need in the new 28 page Catalog #53.



SCOOPMASTER
Eliminates sheet metal collar—directs and controls air

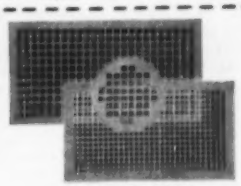


DH DV
SINGLE BANK OUTLET



DDHL DDVL
Triple Bank Registers Individually Adjustable Fins

Opposed-Action Valves
optional with all Supply and Return Air Registers.



PLAIN LATTICE GRILLES

SCOOPTROL
Deflects and controls the air from a supply duct into a collar

Stewart MANUFACTURING CO., INC.
Grove Ave., Essex County, Cedar Grove, N. J.

4241

Representatives in the Principal Cities of United States, Canada and the West Indies.

Electrode-Selector Chart

Electrode-selector chart, designated GEC-657E, contains condensed data on the company's line of mild-steel, low hydrogen-low alloy, low alloy-high tensile, hard-surfacing, and stainless-steel welding electrodes. Tabular material includes welded properties, metal deposit analysis, technique, type of specification requirements met, description and advantages and application data for each type of electrode listed.

Manufacturer—General Electric Co., 1 River Rd., Schenectady 5, N. Y.

Electronic Controls

Bulletin No. B226 describes the company's new line of "Free-Vane" electronic controllers, the latest addition to the Series 500 line of instruments. The manufacturer states that these instruments are available as indicating or recording controllers for temperature, pressure, flow, liquid level, humidity and time program. Complete information on the frequency modulation principle of the control unit, plus data on the combinations of indicators or recording pens and control units available, examples of applications, and complete engineering specifications are included.

Manufacturer—The Bristol Co., P. O. Box 1790, Waterbury 20, Conn.

Fin-Tube Radiators

A new type of fin-tube radiator designed for steam or hot water, high or low pressure heating systems is the subject of a new bulletin. Special design feature of the new heat distributing element is the fin with extruded conductive collar to provide unbroken contact with the steel pipe to utilize all possible heat. The bulletin explains construction of the fin-tube, presents design data and dimensions on the various sizes that are supplied, describes and illustrates typical installations and provides data on users' experiences.

Manufacturer—Lee Vine Fin-Tube Radiator Co., 12 Fair St., New Haven, Conn.

Flame Failure Explosions

"Fireye" Bulletin CP21, *Guarding Your Properties Against Flame Failure Explosions*, is a non-technical explanation of the explosion danger inherent in fuel burning equipment, and the protection now available. The booklet shows how to determine whether a fuel burner is adequately protected against explosion and briefly describes equipment now available which provides protection.

Publisher—Combustion Control Corp., Dept. NB-8, 718 Beacon St., Boston 15.

Float and Lever Valves

Catalog 107 completely illustrates and describes the company's line of float valves for open tanks, balanced lever valves, graduated flow lever valve, tank level control, water control valve, etc. Each type is illustrated by detailed drawings. Information on operation, applications, operating pressure and temperature, construction data and ordering specifications are given. A table of dimensions and weights is included for each model.

Manufacturer—Schade Valve Mfg. Co., 2527-2537 N. Bodine St., Philadelphia 33.

It's the LOW DOWN DIRT trapped by
WILSON'S HAIR FILTERS
that GUARANTEES LONGER LIFE

In Wilson *Hair* Filters the entire dust-holding capacity is completely utilized. This means, *no surface dust stopping only*, but Full-Depth Dust Trapping at its best . . . and many extra months of filter life.

The *reasons* are so simple:

1. The hair media in Wilson *Hair* Filters act in the same manner as Mother Nature's proven way of filtering the air you breathe. It's the *hair* that cleans the air . . . more easily, more effectively, more economically.
2. The multi-directional distribution of the hair in Wilson *Hair* Filters literally invites all dust and dirt to come in and be trapped throughout the entire filter interior.
3. Most brands of air filters require oiling on their inlet surfaces. This stops dust prematurely, loads up the incoming air side and materially shortens filter life.

Wilson Hair Filters are not oiled on the inlet side. Instead, they receive an even distribution of mineral oil *on their outlet surface*, which:

(a) augments the already amazing ability of the hair itself, to catch and hold dust, and—

(b) builds an impregnable barrier which halts dust and dirt after reaching the furthermost practicable penetration point.

WILSON & CO., INC.
(Air Filter Division) 4100 South Ashland Ave., Chicago 9, Ill.

Wilson Hair Filters are another quality product of Wilson & Co., world-famous for meat products, sports equipment, pharmaceuticals, hair products, etc.

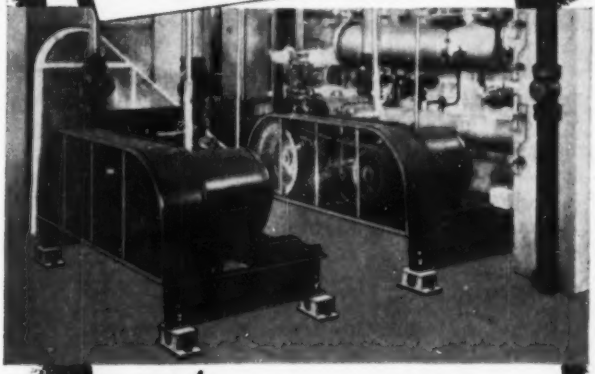
The famous Edgeseal, the original *Hair* Filter with the patented self-sealing edge.

The popular Honeycomb, the dressed up *Hair* Filter that is so easy to handle.

Save delay. Save dollars. Save doubt. Send for FREE sample with details and prices.

WILSON'S HAIR FILTER

STOP VIBRATION



with KORFUND VIBRATION CONTROL

IN A HOSPITAL, quiet areas must be maintained free from vibration and noise. Korfund Isolators were furnished by The Vilter Manufacturing Company for this installation of two of their Vilter Freon VMC Compressors in the new wing of the Milwaukee Hospital, Milwaukee, Wis. Although these compressors were installed close to quiet areas without special foundations, the Korfund Isolators kept vibration and noise well below the requirements.

In addition to insuring quieter operation, Korfund Vibration Control units can:

- Permit installation *anywhere* in apartment, public and industrial buildings
- Decrease original building and foundation costs
- Permit installation without reinforcing floors
- Lengthen machine life
- Permit higher operating speeds — allowing use of smaller units
- Reduce maintenance costs

We'll gladly send more information on Korfund Vibration Control for compressors, fans, pumps, boilers, air conditioners and other equipment. Write today for your free copy of Bulletin No. 7, or see our catalog in Sweet's Files.

For specific recommendations, contact us or your local Korfund office. A half-century of experience is at your disposal.

THE KORFUND CO., INC.

KORFUND VIBRATION CONTROL — SPRINGS — RUBBER — CORK

48-01F Thirty Second Place, Long Island City 1, N. Y.
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal

Born of Experience...

first in 1937 with Blow-Through type evaporative condensers.

PROVED!

BY TROUBLE-FREE PERFORMANCE

SEE US AT THE 8th ALL INDUSTRY REFRIGERATION & AIR CONDITIONING EXPOSITION BOOTH 930.

PERMA-FAN
EVAPORATIVE CONDENSERS

FIRST to offer a blow-through type evaporative condenser that functioned with continuous, trouble-free performance—DRAYER-HANSON now introduces a newly designed, improved and greatly expanded line of evaporative condensers that utilize the blow-through feature along with design improvements in leak-proof housing construction, hot dip galvanized eliminators, circulating pumps, sump pan drainage and protective finish. In addition, corrosion and scaling of fans are eliminated because of fan location in the supply air stream. These newly designed units are manufactured with the same DRAYER-HANSON craftsmanship and high quality materials that earned the 1937 model a well-founded reputation for continuous and dependable service—even up to this date. Available in sizes ranging from 5 to 60 tons at 78°W.B.

For further information, write for free catalog, or consult your DRAYER-HANSON Agent today!

LONG *established in commercial refrigeration and air conditioning, DRAYER-HANSON offers a complete line of commercial refrigeration and air conditioning products.*

SINCE 1919

drayer-hanson

INCORPORATED

3301 MEDFORD STREET • LOS ANGELES 63 • CALIFORNIA

Gas-Fired Unit Heaters

Eight-page catalog contains description, photographs and specifications of the company's propeller fan gas-fired unit heater. Tables and charts show capacities, and physical dimensions of the various models. Detailed explanations cover the advantages and applications of this line.

Manufacturer—Airtherm Mfg. Co., 711 S. Spring Ave., St. Louis 10, Mo.

Gate Valves

Circular No. 561 graphically describes the company's line of iron, bronze mounted "King-clip" gate valves. These valves are designed to permit disassembly and reassembly without removal from the line. The valves also feature large drain channels and cast bronze thread bushings. The circular contains complete specification data and dimensions.

Manufacturer—The Lunkenheimer Co., Box 360, Cincinnati 14, Ohio.

Unit Heater Maintenance and Care

The Industrial Unit Heater Association is again offering its four-page illustrated bulletin, *The Care and Maintenance of Steam and Hot Water Unit Heaters.* Operating diagrams of various types of heaters are shown along with diagrams of proper cleaning methods. One section covers installation information for branches from the steam supply main, low pressure gravity systems, vacuum systems, high pressure systems, strainers and new unit heaters. Another section covers the essentials of maintenance of motors, fans, heating elements and traps and check valves.

Publisher—Industrial Unit Heater Association, 2159 Guardian Bldg., Detroit 12.

Motor Starter Bulletin

Features of Type "H" starters are described in Bulletin 14B6410B. These starters are built to control squirrel cage, synchronous, wound rotor and multi-speed motors in ratings from 2200 to 5000 volts. The starters in ratings up to 3000 hp at 5000 volts are available with air or oil contactors depending on application requirements. How these contactors are made and how they operate is explained in the bulletin. The protection features of the starters—short circuit, overload, time relay undervoltage, and pullout protection—are also covered in the bulletin. Schematic wiring diagrams show typical methods of control.

Manufacturer—Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee, Wis.

Oil Burners

Bulletin No. 175-G covers the manufacturer's extended line of Model "B" and "BR" belt-driven, horizontal, rotary-type, heavy-oil burners. Described in detail are the construction and design features of the oil burner, Model "B" and the oil-gas Model "BR." Features of the burners which are described include the dual-pump reservoir, fuel regulator, belt-drive, air-oil control, fuel feed to atomizer and the long nozzle. Complete specifications, computed at 70 percent thermal efficiency, are given for both types of burners.

ELECTRO
Extra
DYNAMIC
ependable industrial motors

E.D. motors are engineered for *silent* operation with special slot design, dynamic balancing and scientific bearing assembly.

FOR QUIETER OPERATION . . . Over half a century of building motors for "the silent service" to power and air-condition U. S. submarines has given Electro Dynamic an unequalled experience in producing motors for installations where SILENCE is a primary consideration.

WRITE TODAY FOR CATALOGUE NO. 1081

ELECTRO DYNAMIC
DIVISION OF GENERAL DYNAMICS CORPORATION
BAYONNE, NEW JERSEY

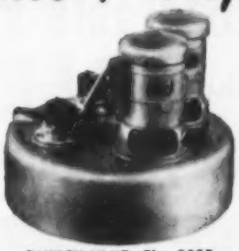
LOW PRESSURE SYSTEM *Condensate Pumps*

SINGLE UNIT—Fig. 302A
10 Gal. Receiver for Single Units
Diameter 21"
Hgt. of Return above floor 6⅞"

Capacities 500 to 10,000 sq. ft. E.D.R.

weil TVC PUMP

LOW RETURN CONNECTION
LOW SPEED, LONG LIFE
CAST IRON RECEIVER
LOW WATER LINE
ELECTRODE OR FLOAT SWITCH CONTROL



DUPLEX UNIT—Fig. 303B
15 Gal. Receiver for Single or Duplex Units
Diameter 25½"
Hgt. of Return above floor 7¾₁₆"

TVC SELECTION TABLE

Unit Number	Max. Sq. Ft. E.D.R.	Discharge Pressure At Pump	G.P.M. From Radiation	Cap. of Pump	H.P. of Motor	Return Inlet	Pump Discharge	Dia. of Receiver	Height of Unit
TVC 13	500	20 lbs.	.25	1.0 GPM	1/4	2"	1"	21"	21"
TVC 19	750	20 lbs.	.38	1.5 GPM	1/4	2"	1"	21"	21"
TVC 23	1000	20 lbs.	.5	1.5 GPM	1/4	2"	1"	21"	21"
TVC 29	2000	20 lbs.	1.0	3.0 GPM	1/4	2"	1"	21"	21"
TVC 35	4000	20 lbs.	2.0	6.0 GPM	1/4	2"	1"	21"	21"
TVC 41	6000	20 lbs.	3.0	9.0 GPM	1/2	2"	1"	21"	23½"
TVC 47	8000	20 lbs.	4.0	12.0 GPM	1/2	2"	1"	25½"	23½"
TVC 52	10000	20 lbs.	5.0	15.0 GPM	3/4	2"	1"	25½"	27½"

See Bulletin TVC-300-C for Full Specifications

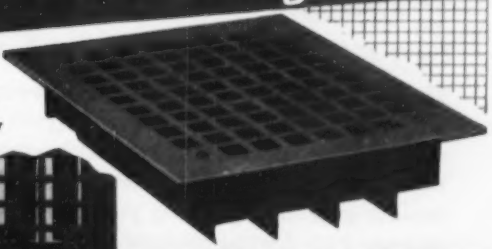
Intermediate Sizes Based Upon Discharge Pressure Required Are Available.

weil PUMP CO. 1514 NORTH FREMONT ST., CHICAGO 22

LEADING CONTRACTORS prefer Auer "K" ALL STEEL REGISTERS for walls or ceilings—

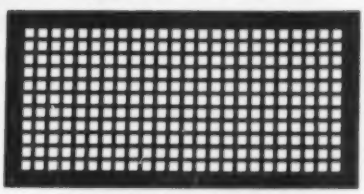
HERE'S WHY:

1. **Greater Strength**—All steel construction—steel body, steel louvres and heavy gauge steel face. Built to take punishment!
2. **Neater Appearance**—Inconspicuous flush-wall installation. Plain lattice pattern blends with any architectural design. Stainless steel, bronze, aluminum, chromium or prime finish faces for painting to match any decorative scheme.
3. **Easier Maintenance**—Flat surface cleans as easily as surrounding wall. Trouble-free working mechanism.
4. **Other Features**—Auer exclusive patented spring-lock louvre adjustment—easy to operate, non-slipping, positive. Key-lock, pole or pulley operated types available. Also available for large registers with multiple units behind a single, continuous face. Auer perforated grilles with matching lattice pattern available in any size.



Auer Fig. K
Steel Register

Auer Fig. KP
Pulley-Operated
Register



Auer Matching Perforated Grille

Write for the "Auer Register Book" showing sizes and types of the complete Auer line of registers and grilles.

Auer REGISTERS and GRILLES

THE AUER REGISTER CO. 6600 CLEMENT AVE. • CLEVELAND 5, OHIO

Canadian Distributor—Marchand Furnace Ltd., Tilbury, Ont.

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Unbeatable Performance of the RIDGID Heavy-Duty Pipe Wrench

Every RIDGID Wrench Factory-Tested

That's what makes sure that every RIDGID performs as you've learned to expect . . . *every* part inspected, *every* wrench pipe tested 100%! Only RIDGID's housing is unconditionally guaranteed, saving you bother and expense. Full-floating hookjaw, adjusting nut spins easily in all sizes, 6″ to 60″; replaceable alloy jaws, handy pipe scale on hookjaw, comfort-grip I-beam handle. For most service for your money, buy RIDGID's . . . at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U.S.A.

RIDGID
Work-Saver Pipe Tools

Manufacturer—Preferred Utilities Mfg. Co., 1860 Broadway, New York 23, N. Y.

Pipe Repair Clamp

Folder No. 201 contains details of the method by which pipe line leaks can be repaired in a matter of seconds, the company states. The folder includes illustrations of the method of installation for both single and double repair clamps and covers ordering specifications and prices.

Manufacturer—Morris Coupling and Clamp Co., Dept. M-5, Ellwood City, Pa.

Pipe and Tubing Stress Values

New data card is designed to help individuals involved in the design and operation of tubular equipment at elevated temperatures and pressures. Known as TDC 154, the data card tabulates the maximum allowable stress values of a complete range of seamless and welded carbon, alloy and stainless steel tubing and pipe. An adaptation of Table P-7 of the new ASME Boiler Code, the data card is complete with notes and formulas for the calculation of the maximum allowable working pressures of tubing and pipe.

Manufacturer—Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa.

Pitot Tubes

Technical Bulletin 51 describes pitot tube construction, principles of operation, application and installation. Formulas for pitot tube calculations including gas flow and liquid flow are given.

Requests for copies should be addressed on company letterhead.

Manufacturer—The Meriam Instrument Co., 10920 Madison Ave., Cleveland 2.

Portable Space Heaters

Brochure covers specifications of the company's addition of new models to its line of "Sonic-Ray" portable space heaters. Model "T" is rated at 85,000 Btu and is thermostatically controlled with an automatic safety shut-off valve. Model "W" is a portable combination water and space heater rated at 85,000 Btu. Three AGA approved models are rated at 50,000 Btu input and are designed for permanent or semi-permanent installation.

Manufacturer—The Bica Co., 1170 N. State St., Girard, Ohio.

Rectifier Welder

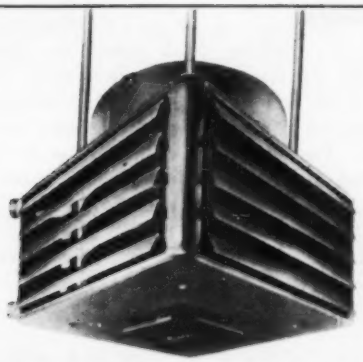
Folder describes the firm's new "SR" line of rectifier type d-c welders, their magnetic amplifier principle, pulsating direct current principle and details of design and construction. Illustrated also are specialized applications—remote control, specialized control, and parallel operation.

Manufacturer—Miller Electric Mfg. Co., Appleton, Wis.

Shears for Metal

Shears for metal working produced by this manufacturer are described in a four-page color bulletin. The bulletin contains specifications on all models of squaring shears including the foot operated types, gap shears and power operated shears.

Manufacturer—Barth Engineering and Mfg. Co., Milldale, Conn.

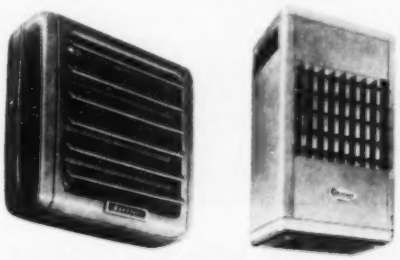


QUICK HEAT

for higher-ceiling spaces

***IN ANY DIRECTION*—1, 2, 3 or 4 sides**
***AT ANY ANGLE*—up or down**
***IN ANY VOLUME*—much or little**

CARRIER Four-way Directed-flo Space Heaters embody many reasons for being regarded as the most efficient and economical units of their type. *Flexibility* is one: independently controlled fan-propelled air streams from four easily adjustable outlets permit varying direction, distance and velocity of warmed air distribution. *Greater heating coverage, any-height installation, lower first cost, lower operating costs and lower maintenance costs* are others. Good styling. Steam or hot water. 82,000 to 500,000 Btu's.



CARRIER Propeller-fan Horizontal Type Unit Heater (*left*). Designed for good looks, high efficiency, and a wide variety of applications for delivering warmed air from heights of 15 to 18 feet. Single-row Aerofin heating coil minimizes air resistance and makes cleaning easy. Steam or hot water, in 10 sizes, 21,000 to 200,000 Btu's.

CARRIER Gas-fired Unit Heater (*right*) has one-piece heat exchanger and combustion chamber of high-heat-resisting Aluminized Steel. AGA-approved for all gases. In 7 sizes, 70,000 to 230,000 Btu's. Propeller-fan type (illustrated) or duct type.

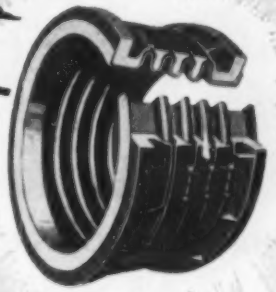
CARRIER Blower-fan Type Heat Diffusers assure economical and efficient heating and ventilating in practically all kinds of industrial and commercial buildings. Sectionalized for easy on-the-job conversions into a variety of arrangements. In 6 sizes to 2,390,000 Btu's. Air handling to 31,000 cfm. Available for steam or hot water.

For further information on any of above products, write to Carrier Corporation, Syracuse, New York.

Carrier

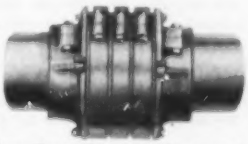
AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

Designed for **DURABILITY** as well as Flexibility



DURABILITY is designed into the Badger Directed-Flexing, Self-Equalizing Joints:

1. each corrugation is designed with the proper depth for its diameter; each diameter is gauged to its proper traverse.
2. each corrugation—and it's the Badger *all curve* corrugation—is shaped to flex by Directed Flexing using matching shaped equalizing rings to guide and control the flexing movement. The corrugation wraps and unwraps itself, using the rings as the bearing surface, distributing the flexing stresses evenly over all areas of each of the all-curve corrugations.
3. each corrugation is progressively controlled and limited to its proper flexing traverse.
4. the corrugations are formed from a single metal tube of suitable length by a special forming process which minimizes forming stresses in the metal.
5. every joint is scientifically heat-treated at each of several key steps in its manufacture.



The many thousands of Badger Directed-Flexing, Self-Equalizing Expansion Joints in service now for many years are in themselves testimonials as to their durability. They will serve you equally well. With a wide range of sizes in either flanged or welding end design, with a choice of several metals, with facilities for designing special joints, why not let our expansion joint specialists take care of your requirements?

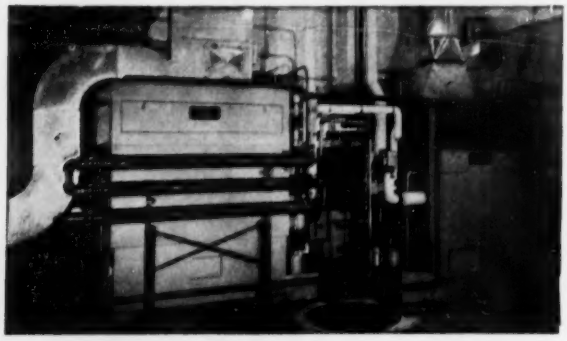
BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE • MASS.

This NEW METHOD DRIES AIR

PRECISELY AS YOU WANT IT



NIAGARA CONTROLLED HUMIDITY AIR CONDITIONING

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

For complete information write

NIAGARA BLOWER COMPANY

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Sales Engineers in Principal Cities of U. S. and Canada

Slub Eliminator

Bulletin SE-1 shows in diagrammatic drawings the operation of a slug eliminator. This device is placed in the suction line of a refrigeration compressor and is designed to prevent liquid slugbacks and to insure oil return. The bulletin describes its use in conjunction with flooded or dry expansion chillers, finned coils and as a hot gas defroster, in sizes from 2 to 50 tons of refrigeration capacity.

Manufacturer—M. Blazer & Son, 173 Market St., Passaic, N. J.

Spreader Stoker

Sixteen-page illustrated bulletin describes the relatively small spreader stoker for boilers and steam generators, the "RotoStoker Type C-C." Its steam output capacity is approximately 5000 to 75,000 lb per hr. According to the manufacturer, it is adaptable to all types of steam boilers and steam generators and offers continuous cleaning and ash discharge advantages of larger stokers without the necessity of a basement for ash removal. The operation is automatic in which the fuel supply, air supply and ash discharge are synchronized with the steam demand. The fuel bed is continuously cleaned and the ash discharged at the front either at the operating floor level or from the ash hopper beneath.

Manufacturer—Detroit Stoker Co., General Motors Bldg., Detroit 2.

Steel Balls

A new leaflet, containing information on "Fischer" steel balls and their applications, has been published by the United States distributor for Kugelfischer Georg Schafer & Co., Schweinfurt, Germany, manufacturer of the balls. Listed is the complete line of applications for chrome steel balls, stainless steel balls and other balls. Under each listing are the applications for bearings in valves and pumps, armatures, as casters, burnishing balls, gage balls and crushing and grinding balls.

Distributor—Frazar & Co., Inc., 50 Church St., New York 7, N. Y.

Welded Insulation Fasteners

Revised file of application data and specifications covers the methods for securing various types of insulation by the use of stud welded fasteners. Basic types of fasteners covered are: headed insulation studs; slotted lagging studs; headless studs; split studs; and rectangular metal lath studs.

Manufacturer—The Nelson Stud Welding Div. of Gregory Industries, Inc., Lorain, Ohio.

Welding of Nickel Alloy Steels

Bulletin A-93 is a study of the various welding techniques, including some of the newer inert gas processes, electrodes, preheat treatments and post heat treatments. Typical results that can be expected are given for the low alloy high strength steels, low carbon and medium carbon engineering alloy steels and special steels. The 44-page booklet contains tables, graphs and illustrations.

Publisher—The International Nickel Co., 67 Wall St., New York 5.

Available in all piping materials!

ALLOY OR NON-FERROUS PIPING is often the answer to problems of contamination, corrosive action, severe pressures and temperatures, or cyclic operation. You can obtain TUBE-TURN Welding Fittings and Flanges of stainless steels, nickel and nickel-base alloys, copper and copper-base alloys, aluminum and aluminum-base alloys, and newest of all, titanium. For good service in welding fittings, in carbon steels, or in alloy or non-ferrous metals, call your nearby TUBE TURNS' Distributor. He's ready to serve you from industry's most complete line.

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ENGINEERING SERVICE

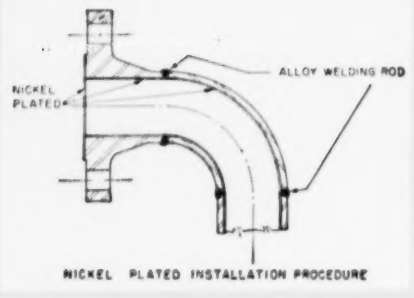
TUBE TURNS' *Engineering Service*

can help you cut cost of corrosion-resistant piping

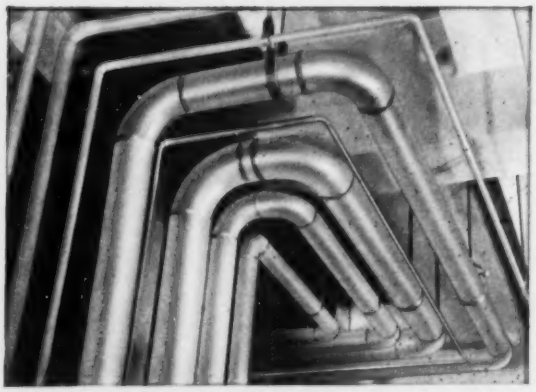
G. A. GAUM is one of TUBE TURNS' Engineering Service Division men spending a great deal of time in the field obtaining performance data that contributes to improved piping technology.

THE COST of corrosion-resistant piping can often be minimized by the use of standard carbon steel piping *plated* on the inner surface with such materials as nickel, copper, etc. In atomic energy plants, nickel-plated piping in sizes through 42" is giving satisfactory service, and has substantially reduced original cost. The method is also applicable to many industrial processes where corrosion resistant materials are specified.

Such plating is generally .008" thick, and can be applied in heavier thicknesses where desirable. You can obtain recommendations on preferred plating sources, proper welding techniques and rods from TUBE TURNS' Engineering Service—always ready to help you with special piping problems.



Installation procedure for nickel plated welding fittings and flanges.



These welded aluminum lines, fabricated with TUBE-TURN Welding Fittings, are permanently leakproof, reducing maintenance to a minimum. Since Tube Turns, Inc. offers the world's broadest line of welding fittings and flanges, all necessary types of welding fittings for any job can be obtained from one reliable source.

Dimensional accuracy of TUBE-TURN Welding Fittings speeds fabrication in the shop or in the field. True circularity and uniform wall thickness assure perfect alignment. Each TUBE-TURN welding fitting is individually examined by skilled inspectors for accuracy.

Want Piping Information?

TUBE TURNS, INC. is recognized the world over for its leadership, not only in the field of welding fittings and flanges, but as a source of authentic information on piping design. Check the coupon below for bulletins you would like to receive.

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224 East Broadway, Louisville 1, Kentucky

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TUBE TURNS, INC.

LOUISVILLE 1, KENTUCKY

EAST SIDE, WEST SIDE, all around the town . . . 91% of the buildings that make up the fabulous New York skyline are **p-k** equipped. This preference for **p-k** heat exchange equipment — including instantaneous hot water heaters, storage water heaters, pre-heaters, condensate coolers, converters, freon coolers — is understandable because **p-k** fully guarantees its equipment, backs it with 73 years of heat exchange experience.

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HEATING, PIPING & AIR CONDITIONING

STANDARD EDITORIAL CONTENT . . . . . .

January HP & AC will be a "regular issue" in every respect. It will carry a full quota of timely articles, and the Journal Section of the American Society of Heating and Ventilating Engineers—the same as in every issue of this field-leading book. For extra attention value, it will have heavy covers, and be specially mailed.

DIRECTORY SECTION . . . .

Every product used in industrial and large building air conditioning, heating and piping will be listed. We'll tell who makes these products and their trade names. All advertisers as they appear in this Directory Section will be prominently identified indicating that more detailed information is elsewhere in the issue. It's the industry's best and most complete BUYING GUIDE—printed on colored stock in a special section.

Here's a regular issue, and a directory issue, combined in one great January number . . . . and *no advance* over regular issue rates!

Here your advertising will get *increased attention*, and have *lasting sales power* (as product reference copy) throughout all of 1954.

Here is the "best buy" of the year in our field . . . . the place where a convincing sales story of your complete facilities will do you untold good.

Here is where *extra* space for *extra* emphasis belongs!

Most advertisers use increased space with us in January —spreads, inserts, color. They catalog their entire lines. You, too, can profit most by doing a complete job. Make space reservation now . . . . we'll be glad to help with copy preparation if needed.

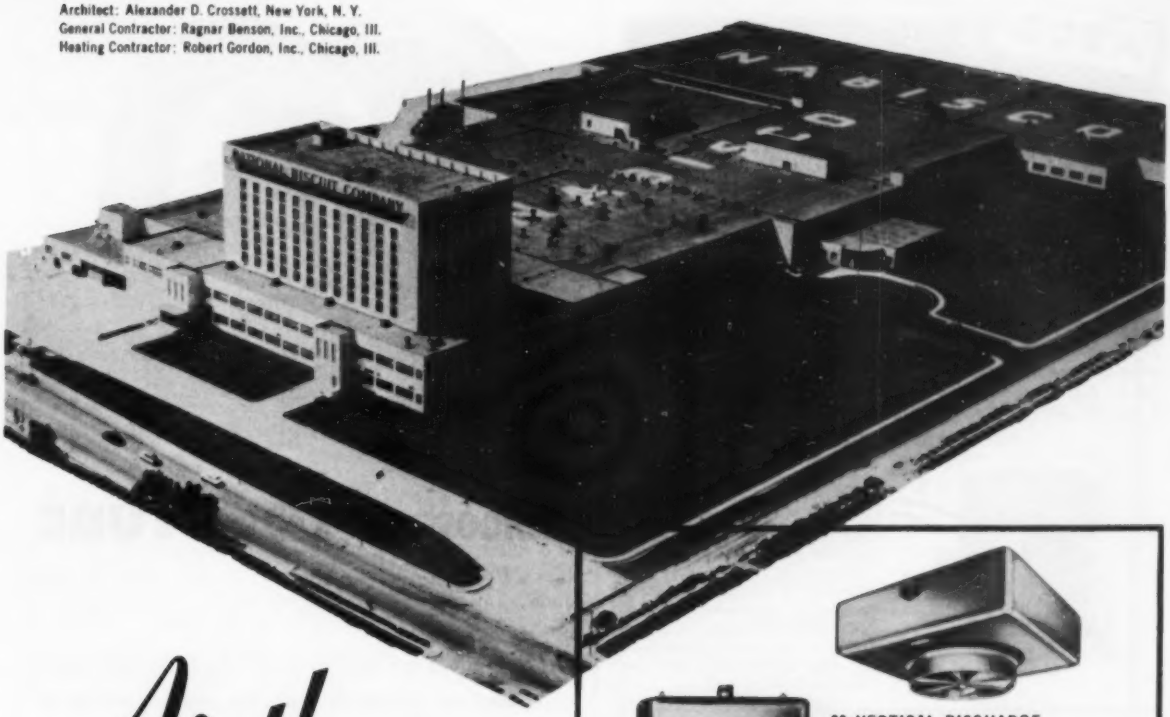
Heating, Piping & Air Conditioning

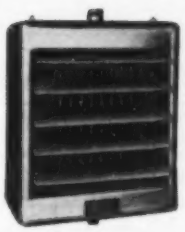
6 North Michigan Avenue

Chicago 2, Illinois

National Biscuit Company
Chicago, Illinois

Architect: Alexander D. Crossett, New York, N. Y.
General Contractor: Ragnar Benson, Inc., Chicago, Ill.
Heating Contractor: Robert Gordon, Inc., Chicago, Ill.





90 VERTICAL DISCHARGE HEATERS INSTALLED from 102,500 BTU to 185,000 BTU

92 HORIZONTAL DISCHARGE HEATERS INSTALLED from 14,800 BTU to 250,000 BTU

Airtherm STEAM UNIT HEATERS

WARM THE WORLD'S LARGEST BAKERY

To achieve flexible, economical heating throughout Nabisco's new $20 million Chicago plant, 182 Airtherm steam unit heaters have been installed. The plant is the world's largest cracker and biscuit bakery with ovens the length of football fields, almost 20 acres of floor space and a capacity of 167 million pounds yearly.

When the area to be heated presents unusual problems, chances are you can solve them easily and economically with the flexibility of Airtherm unit heaters.

For Heating Satisfaction . . . Think First of *Airtherm*

Oil or Gas Direct Fired Heaters

Gas Fired Unit Heaters

Convectors

Centrifugal Fan Unit Heaters

See Your Wholesaler, or Write

AIRTHERM MANUFACTURING COMPANY
711 S. Spring Ave., St. Louis 10, Mo.

AT-150

ADDED FEATURE in Midget 2 & 3 Way Solenoid Valves

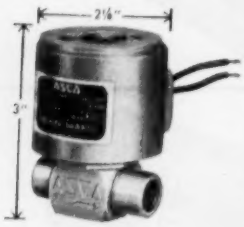
ASCO

Explosion-Proof

protection for

Personnel, Production & Plant

ASCO Midget Valves are now available with explosion-proof housings, designed in accordance with Underwriters' recommendations for use in Class 1, Group D hazardous locations. These Bulletins 8262 & 8314 ASCO Valves with the Explosion-Proof Solenoid Enclosure (they're also water tight) may be just what you need. Classed as "small" valves, they are doing a big job in the automatic and remote control of air, gas, water, light oils, refrigeration and other fluids.



Bulletin 8262 Two-Way ASCO Solenoid Valves (Illustrated) can be obtained with by-pass and metering devices. Valves can be installed in any position. Bulletin 8314 Three-Way Valves can be applied to any 3-way valving requirement regardless of flow directions or pressure application points; no change of springs or other adjustments are necessary. These valves can also be mounted in any position and will give positive tight shut-off.

BULLETIN 8262

2-Way Valve (Normally Closed)••

(Available for all commercial and industrial voltages)

Body Material		Brass or Stainless Steel			
Pipe Sizes (inches)		1/8		1/4	
Orifice Diameters (inches)		1/16	1/8	5/32	3/16
Maximum Pressures lbs./sq. in.	A-C	300*	130	90	60
	D-C	250	70	50	30

*Available 1000 psi in stainless steel; 500 psi in brass.
**Also available normally opened.

BULLETIN 8314

3-Way Valve

(Available for all commercial and industrial voltages)

Body Material		Brass or Stainless Steel	
Pipe Size (inches)		1/8	
Orifice Diameters (inches)		3/64	3/32
Maximum Pressures lbs./sq. in.	A-C	125	45*
	D-C	50	25*

*Pressures slightly lower for liquids.

Since 1888 ASCO Engineers have specialized in the constantly expanding field of Electromagnetic Controls. They have pioneered many new developments and have revolutionized many of the older concepts of automatic controls. Industry looks upon ASCO as one of the leaders in Electromagnetic Controls. Why not let our engineers help you with your problem whether it involves control on a machine of any kind you are designing or control of liquid or gas in your plant?

We also manufacture other types of Electromagnetic Controls including Automatic Transfer Switches, Remote Control Switches, Contactors, Relays and complete Control Panels.

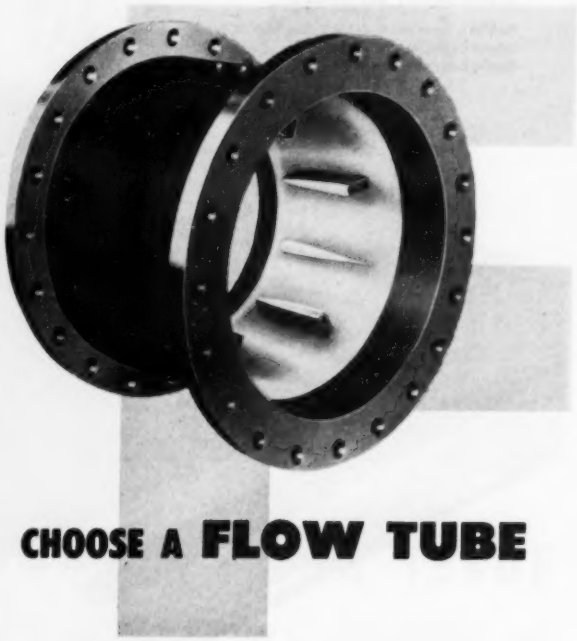
Write for free pamphlet "Small Solenoid Valves."

ASCO Solenoid Valves

Automatic Switch Co.

389 LAKESIDE AVENUE · ORANGE, NEW JERSEY

FOR ACCURACY IN METERING



CHOOSE A FLOW TUBE

Flow Tubes are furnished with head capacity curves based on laboratory tests. For unusual piping arrangements, special tests can be run simulating actual conditions. The data furnished with each Flow Tube makes exceptional metering accuracy possible.

Flow Tubes have many other plus values — they're compact, comparatively light weight, and are easy to install since they require minimum straight runs entering and following. And, Flow Tubes are available in types and D/d ratios to provide differentials that can be accurately measured with the least head loss.

That's why Flow Tubes are being successfully used in scores of installations metering the flow of liquids and wet or dry gases. Available in all pipe sizes and suitable metals. They can be furnished with or without suitable secondary indicating, recording or totalizing instruments. Write for further information. For specific recommendations, send us necessary flow data.

FOSTER AUTOMATIC VALVES

PRESSURE REGULATORS • RELIEF AND BACK PRESSURE VALVES • CUSHION CHECK VALVES • FAN ENGINE REGULATORS • PUMP GOVERNORS • TEMPERATURE REGULATORS • FLOAT AND LEVER BALANCED VALVES • NON-RETURN VALVES • VACUUM REGULATORS OR BREAKERS • STRAINERS • SIRENS • SAFETY VALVES • FLOW TUBES

FOSTER ENGINEERING COMPANY · UNION, N. J.

WE HEAR THAT . . .

After more than 60 years of operation in the wholesale distribution of heating, refrigeration and plumbing products in the Chicago area, *WEIL-McLAIN CO.* last month discontinued its Wholesale Div., which has been acquired by the *COLUMBIA PIPE & SUPPLY CO.*, 1120 W. Pershing Rd., Chicago. The unit at 850 165th St., Hammond, Ind., will be maintained by Columbia as a going concern. The change was made so that Weil-McLain can devote its entire resources to the manufacture of boilers, radiators and other heating products. . . . *JAMES B. CLOW & SONS* has acquired Weil-McLain's Automatic Heating and Cooling Supply Div. This marks Clow's entry into the commercial refrigeration field as a distributor, and rounds out Clow's wholesale distribution. All personnel and inventory have been moved to the Clow headquarters at 201-299 N. Talman to become a department of the jobbing division.

With the completion of a 30,000 sq ft addition to its Memphis, Tenn. plant, *FLEXONICS CORP.* has tranferred its brass bellows production to Memphis from the pilot plant at Elgin, Ill. The additional space will enable the company to increase the output of the bellows about six times. *NORMAN DAWSON*, who has been quality control manager at Elgin, has become superintendent of the Brass Bellows Div. at Memphis. *FRANK BRENCE* is continuing as Memphis factory manager. Employees on brass bellows work at Elgin are being put on other operations there.

New warehouse facilities to benefit dealers in northern Indiana have been acquired by the *MEYER FURNACE CO.* A complete stock will be maintained at the Merchandise Warehouse Co., 1102 S. Main, Kokomo. The company is represented in the northern Indiana territory by *PHIL C. LOUTTIT*, 613 Holly Lane.

The addition of alloy bars to its present stock has been announced by *TUBE DISTRIBUTORS CO., INC.*, suppliers of alloy, stainless and carbon steel tubing and boiler tubes. The company recently moved its offices, stock and processing machinery to new quarters at Garden City, N.Y.

REVCOR recently moved from its Chicago offices to a new, modern plant at Carpentersville, Ill. The new plant will provide facilities for research, design and engineering, and greater manufacturing volume.

A working model of a hot strip mill was sent to the Ohio State Fair this year by the *YOUNGSTOWN SHEET and TUBE CO.* The 31-ft model was built in the company's plant by the two men who operated it at the fair. Lead was used to show how steel is rolled.

A vacuum furnace for annealing tubing of titanium and zirconium is being installed by the *SUPERIOR TUBE*

Johnson & Johnson's

new Shipping Center in Raritan Township, N. J., calls for the maximum in efficiency and trouble-free Multi-blade Damper operation. All of the 60 Damper units installed by the Hutchinson Ventilating Co., White Plains, N. Y., were assembled with . . .

Damper being inspected at the Hutchinson shop. Self-centering feature of "Duro Bracket" assures smooth, non-binding operation.

"DURO BLADE KIT"

PRECISION-ENGINEERED

DAMPER HARDWARE

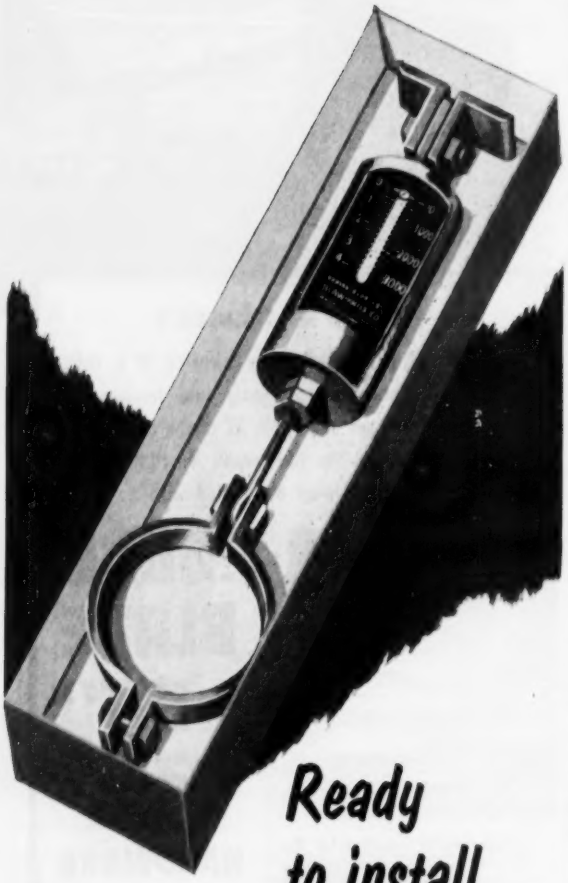
Thousands of Engineers and Sheet Metal Fabricators specify and use "Duro-Blade-Kit" on their Damper jobs, because...

Model shows how either parallel or opposed blade action is accomplished.

- Produces highest quality commercial Damper known.
- Self-centering "Duro Bracket" assures smooth, non-binding operation.
- Sturdy, solid construction permits use on heaviest Dampers.
- All materials corrosion-resistant.
- Fits all blades 3 inches or wider. Parallel or Opposed Blade action.
- Easily adjusted even after being installed.
- Excellent for making Approved Fire Dampers.

WRITE for Free Demonstration Kit and illustrated Manual on the construction of "Approved" Dampers

DURO-DYNE CORPORATION Dept. D
38 SOUTH FRANKLIN STREET, HEMPSTEAD, L. I., N. Y.



Ready to install as received

For any piping installation in which flexibility is important

BLAW-KNOX HANGERS

with patented Internal Swivel Action are "made-to-order." Each is a complete packaged unit . . . saving you expensive cutting, threading and assembling in the field. Other supports developed by Blaw-Knox Power Piping engineers include Overhead Roller Assemblies, Rigid Hanger Assemblies and Vibration Eliminators for any piping requirement. If you want data that will speed your specifications and cut your engineering time send for Catalog #51.

BLAW-KNOX COMPANY
POWER PIPING AND SPRINKLER DIVISION
PITTSBURGH 33, PA. • CEdar 1-0700

BLAW-KNOX

CO. The new furnace is the batch type and can handle tubings in lengths up to 24 ft. After six years of metallurgical development the company is mass producing small titanium tubing in OD sizes from .125 to 1.500 in., and in wall thicknesses from .004 to .187 in.

The *WESTINGHOUSE ELECTRIC CORP.* will re-enter the field of room air conditioning in 1954 with a new line of small units. The line will be shown to the company's major appliance distributors this fall and will be available at the retail level early next year. Westinghouse has not produced room air conditioners since 1942.

Construction is underway in Cleveland on a new laboratory building for the *FORBES FINISHES DIV. of PITTSBURGH PLATE GLASS CO.* Planned essentially as a lacquer development laboratory, it will be completely air conditioned to provide the humidity control necessary to lacquer development work.

An assistant chief engineer of the Nationalist Chinese Government's arsenal on Formosa and an engineering trainee from India were among a group who toured the *L. J. MUELLER FURNACE CO.* in Milwaukee recently. The group was studying mass production methods of American industry.

More than 20 evening and Saturday morning courses in engineering are being offered this fall by the *NORTHWESTERN UNIVERSITY TECHNOLOGICAL INSTITUTE* to make it possible for qualified practicing engineers with professional and family responsibilities to continue in advanced studies. Additional courses will be given in succeeding quarters.

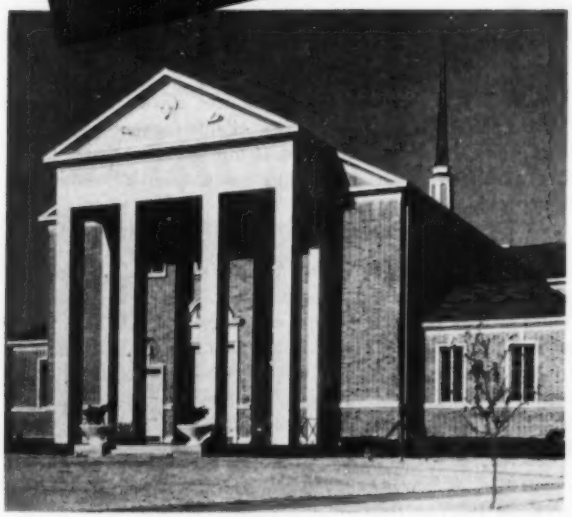
Graduates of engineering or applied sciences can register for fully accredited courses in chemical, electrical, and mechanical engineering leading to a master's degree while continuing full-time jobs in industry. A student may pursue advanced studies without qualifying for a degree by registering as a special student. All classes are meeting at the Technological Institute, Evanston, Ill., where students have the advantage of 20 laboratories.

A new industrial expansion program is in progress at the Mattoon, Ill. plant of the *YOUNG RADIATOR CO.* The new construction will be a 20,000 sq ft, one-story structure adjoining the main buildings.

A New York office and laboratory has been opened by the *SOLA CATALYTIC CO.* of Dallas. Located at 55 W. 42nd St., it is known as the *EASTERN SOLA CATALYTIC CO.* The sales and service facilities for the eastern operations will be under the direction of *DONALD MARTIN*, vice president of sales.

A recent issue of *Valve Values*, the house organ of *EDWARD VALVES, INC.*, was devoted to a description of the company's engineering and research facilities as part of the 30-year research anniversary. The anniversary year was marked by the coordination of all engineer-

Where the best in air conditioning is required . . . specify . . .
DOLE ICE-CELS



AIR CONDITIONING . . . INSTALLED IN HIGHLAND PARK METHODIST CHURCH OF DALLAS, TEXAS

APPLICATION: DOLE ICE-CEL units hooked up with two 15 H.P. compressors — combined capacity of 200 ton hours of refrigeration.

LOAD: 80 tons an hour for two and one half hours — in excess of actual requirements, which can be utilized with compressor input for special occasions.

DOLE ICE-CEL units are available for low cost installation in churches, halls, mortuaries, cafeterias, offices and retail stores.

WRITE FOR CATALOG BE

DOLE REFRIGERATING COMPANY

5918 N. Pulaski Road, Chicago 30, Ill.
103 Park Avenue, New York 17
In Canada: Dole Refrigerating Products, Ltd.
44 Elgin Street, Brantford, Ontario

Maximum Refrigeration Efficiency

DOLE

MANUFACTURERS OF
THE Cel LINE

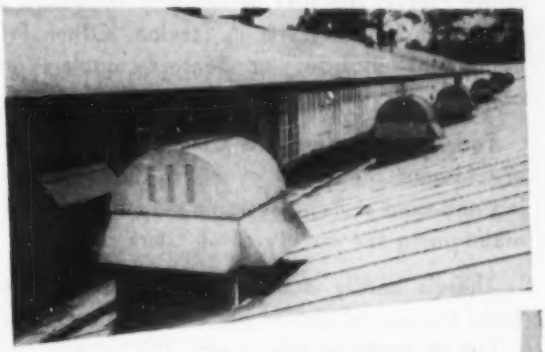
Piasecki

KNOWS AIR MOVEMENT . . .

. . . CHOOSES

PENN VENTILATORS

For Efficient and Economical Ventilation of Office & Plant Facilities



● More than thirty Penn Ventilators exhaust air from the office and mammoth shop facilities of Piasecki Helicopter Corp. in Morton, Penna.

You, too, can depend on Penn Ventilators to make conditions more favorable in your plant. There is a type and size to accommodate most general ventilation requirements. Call the Penn Ventilator man in your area or write . . .

Complete Literature Available — Write Engr. Dept.

PENN VENTILATOR COMPANY

Representatives and Distributors in Principal Cities

PHILADELPHIA 40, PENNA.

FOR MORE THAN 25 YEARS THE BUILDERS' ROOF TOP LINE

Famous Pittsburgh firm uses

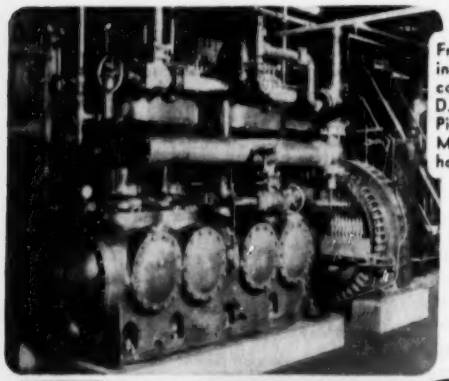
Frick Refrigeration

35 years, and finds it very dependable

The D. L. Clark Company, manufacturers of the world famous Clark Bar, and Clark Brothers Chewing Gum Company now operate eight large Frick refrigerating machines in their Pittsburgh Plants. The first of these compressors, installed in 1918, is still in service. Other Frick equipment includes condensers, coolers and controls.

Today, Clark Bars and Clark's Teaberry Gum are famous the world over. Frick air conditioning and cold storage systems play a vital part in maintaining the quality of all Clark products.

There's hardly a business that cannot profit from the use of similar Frick cooling equipment. Let us quote on the system YOU need.



Frick 4-cylinder ammonia compressor at D. L. Clark Co., Pittsburgh. Motor has 300 horsepower.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery

ing and research activities under the supervision of *L. H. CARR* and by the completion of new buildings and the installation of testing equipment.

PENN CONTROLS, INC. recently held a week long conference of the entire sales organization at the main office and factory in Goshen, Ind. District managers, sales engineers and representatives from sales offices throughout the United States and Canada, as well as company officials, took part in the conference. The five-day meeting stressed increased customer service, new products and product information and new market developments and potentials.

Work is underway on the erection of a west coast plant for *BUSH MFG. CO.* The new plant, located in Riverside, Calif., will be 33,000 sq ft and is being built on a nine acre plot to allow for future expansion. Completion is expected by December 1.

The *YOUNGSTOWN SHEET and TUBE CO.* has acquired an interest in the Perrault Fibercast Corp. of Tulsa. This concern, which in the future will be known as the *FIBERCAST CORP.*, manufactures glass fiber-reinforced thermo-setting plastic pipe. It will be distributed through Continental Supply Co., the Youngstown Steel Products Co. and the Youngstown Steel Products Co. of California.

The *WESTINGHOUSE ELECTRIC CORP.* plant at Attica, N.Y., which has been building industrial stokers, will become a branch plant of the Westinghouse Motor and Control Div. whose main plant is in Buffalo. With the corporation leaving the industrial stoker manufacturing field, the Attica plant will produce parts for electric motors and some other products. The present management staff will remain in charge of operations.

GENERAL CONTROLS CO., which is now building a new plant for its Appliance Controls Div. in Burbank, Calif., just across the city boundary line from the company's main plant in Glendale, has concluded a lease arrangement for five acres of additional land between the two plants. The land will be used for parking area and future plant expansion.

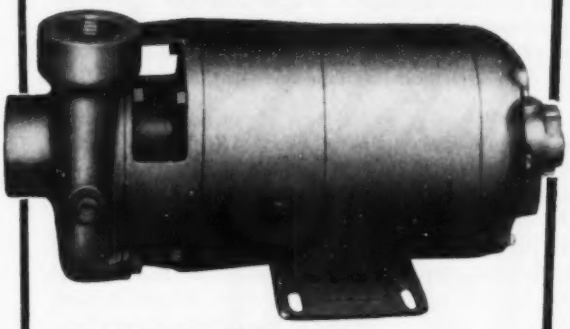
HAJOCA CORP., manufacturers and distributors of heating, industrial, refrigeration and plumbing equipment, recently held a formal opening of its new branch office located at 119 W. Third St., Lewes, Del. The establishment of the Lewes branch, which serves the Del-Mar-Va Peninsula area, is the 34th of the Atlantic seaboard branches. Newly appointed manager is *CARL F. BARLEY*, who has been with the firm since 1936.

Two regional sales meetings, one in Chicago and the other in New York, have recently been held by the *UNITED STATES RADIATOR CORP.* New models of summer air conditioners, boilers and radiant baseboards were introduced to the sales force.

For all three

1 ECONOMY
2 PERFORMANCE
3 COMPACTNESS

CARVER Model B ELECTROPUMPS



- Mechanical Shaft Seals
- Stainless Steel Shafts
- Enclosed Bronze Impellers
- Rotatable Volute Casings
- Grease-Sealed Heavy-Duty Ball Bearings
- Top Quality Motors
- Capacities up to 70 GPM Heads up to 110 Feet
- Two Sizes: 1" and 1¼" Discharge

CARVER introduces a brand new line of small end-suction centrifugal pumps designed to efficiently and economically solve your pumping problems.

These versatile Carver Model B Electropumps are durable, efficient pumps, close-coupled to high-grade continuous-duty, jet pump motors of standard NEMA dimensions. Though compact in size, and very reasonable in cost, they are built for continuous hard service and backed by CARVER'S one year guarantee. Your best buy for better performance in every way.

Carver's broad line of centrifugal pumps includes many sizes and types (end suction, split case, self priming) in capacities up to 4200 GPM, pressures up to 135 pounds.

Ask for Bulletin No. 211

CARVER PUMP COMPANY
1460 Hershey Ave., Muscatine, Iowa

CARVER **CARVER PUMPS**

For HARD-TO-HEAT Buildings

THERMOBLOC

SELF-CONTAINED DIRECT-FIRED HEATERS

save up to 1/3 on heating costs

Uniform temperatures at working levels . . . high heating efficiency (82-86%) . . . no costly pipes, ducts or radiators . . . automatic temperature controls—these are only a few of the many advantages you get with THERMOBLOC Heaters.

HEAT COMFORT FOR ALL BUILDINGS
Thermobloc Heaters provide continuous 360° gentle circulation of live, warm air at working level—no drafts, no heat loss in roof trusses in such hard-to-heat buildings as railroad roundhouses, foundries, factories, warehouses, truck terminals, or wherever there is a large open area.

LOW COST HEATING
Completely installed Thermobloc costs about ⅓ of conventional systems. Fuel savings result from more efficient heat distribution. No heat losses due to radiation.

SPACE SAVING
Occupies smallest floor area per btu of any direct-fired heater.

ALL SIZES FOR ALL PLANTS

For complete details, mail the coupon today.

THERMOBLOC DIVISION
PRAT-DANIEL CORPORATION
Manufacturers of P-D Power Plant Equipment
5-10 Meadow Street Norwalk, Conn.

THERMOBLOC DIVISION
Prat-Daniel Corporation
5-10 Meadow Street, Norwalk, Conn.
Gentlemen:
Please send me complete details on Thermobloc Heaters
NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

WHO'S WHAT...

MATTHEW M. LAWLER has been named vice president in charge of the Air Conditioning and Refrigeration Div. for the *WORTHINGTON CORP.* Mr. Lawler joined the company in 1936 and has served in the capacity of assistant vice president and manager of the Air Conditioning and Refrigeration Sales Div. since 1950.

W. E. GLEESON, during recent years western district manager of *McDONNELL & MILLER, INC.*, now is sales promotion manager at the company's home office in Chicago.

ROBERT W. LEAR has been appointed general marketing manager of the radiator heating and plumbing division of *AMERICAN RADIATOR & STANDARD SANITARY CORP.* In this position Mr. Lear will direct all staff sales activities for the division. *ROBERT W. WILLIAMS* has been appointed advertising and sales promotion manager, succeeding Mr. Lear. Headquarters of both men will be in the Pittsburgh offices of the company.

W. R. MARSHALL, JR., has been appointed associate dean of the College of Engineering and associate director of the Engineering Experiment Station at the *UNIVERSITY OF WISCONSIN.* He still retains an appointment in the Chemical Engineering Dept. with the new rank of professor. His new duties will consist primarily of coordinating the research activities of the entire college as well as the activities of the experiment station. Professor Marshall is the author of several articles on drying which have been published in HPAC.

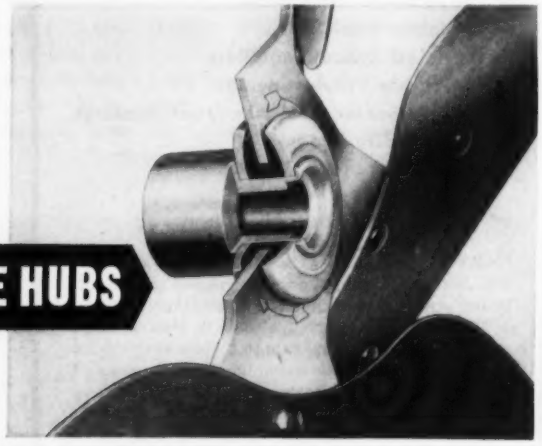
CHARLES H. SMITH, who joined the *L. J. WING MFG. CO.* in 1920, has been named vice president in addition to his duties as secretary and director. Mr. Smith now heads the Combustion Div. and will in addition be in charge of labor relations, agency relations, supervisor training, advertising and publicity.

Other appointments announced by the Wing company are *THOMAS R. HARDEN* as a mechanical engineer in the Heating & Ventilating Sales Dept., and *A. T. BAHEL* as advertising manager.

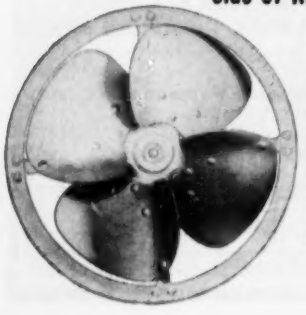
SHERMAN T. RAMEY has been appointed advertising manager of the *TIMKEN-DETROIT AXLE CO.*, according to an announcement by *F. W. PARKER, JR.*, executive vice president. In his new post Mr. Ramey will be in charge of the advertising activities of both the Timken-Detroit Axle Div. and the Timken Silent Automatic Div.

The appointment of *DONALD H. KRANS* as director of the new research and testing laboratory has been announced by the *TRANE CO.* Among the projects which will be carried on under his direction will be basic research, product development and testing of equipment on school heating and ventilating, residential heating and cooling, special hospital operating room air conditioning

REDUCE MOTOR NOISE
ON MOST FAN APPLICATIONS
WITH TORRINGTON'S NEOPRENE HUBS



SLINGER RING FANS for use on the Condenser side of Room Air Conditioners



Sturdy construction resists accidental damage, maintains alignment, concentricity and balance. Ring location variable with respect to trailing edge of fan. Available in 3- or 4-bladed 10, 11 and 12" fans with 11½, 12½, 13¼ or 13½ diameter slinger rings. Pitch range: 16 to 40 degrees.

By insulating the fan blades from the motor, Torrington neoprene insulated hubs prevent amplification of noise originating from the motor. Specifying neoprene insulated hubs is a constructive step toward a unit's commercial acceptance.

THE TORRINGTON MANUFACTURING COMPANY
TORRINGTON, CONNECTICUT
Western Division: Van Nuys, Calif. In Canada: TMCo., Ltd., Oakville, Ont.

No longer is it necessary to invest in dual fuel to utilize gas.

just *Add* gas!

. . . . . WEBSTER'S REVOLUTIONARY PACKAGED RECTILINEAR* GAS BURNER

The Packaged Rectilinear makes four inches pressure do the work of four pounds with fractional horsepower.

You can fire gas — automatically — through any narrow opening without disturbing your present firing equipment — hand or stoker fired coal, oil or whatever it may be.

*TRADEMARK

Write for Literature

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

NEW! Bahnson Type E Self-Contained HUMIDIFIER

for COMMERCIAL and INDUSTRIAL applications

Here is the answer to many of your humidification problems. The Type E Humidifier uses Bahnson's "time-proved" principle of centrifugal atomization of city or well water, at any pressure up to 80 psi.

VERSATILE! This one unit fits many applications—from large commercial rooms to all types of industrial spaces—wherever humidity control is desired. Type E units have a wide range of uses:

- for *complete humidification* systems
- for *spot humidification* in large spaces
- for *boosting* existing systems
- for *precise humidity control* in laboratories and conditioning cabinets

EXCEPTIONAL FEATURES

- SINGLE or MULTIPLE installation, with individual or group automatic controls.
- HIGH CAPACITY—Evaporates up to 3 gph with 1/4 horsepower motor.
- SELF-CONTAINED—Needs no pump, duct, compressed air, steam, drain, or floor space.
- COMPACT—Only 18" in diameter; easy to install. Factory assembled and tested.
- TROUBLE-FREE—Simple to operate and maintain. Constructed of non-corrosive metals.

BACKED BY EXPERIENCE Bahnson builds the world's most complete line of industrial humidification equipment. The Type E is only one of a number of units available. For larger industrial jobs, get information on our Centrifugal Humidifiers (capacity to 12 gph) or Type BA-2 (capacity to 18 gph).

If you have a specific application, send data for our complete recommendations.

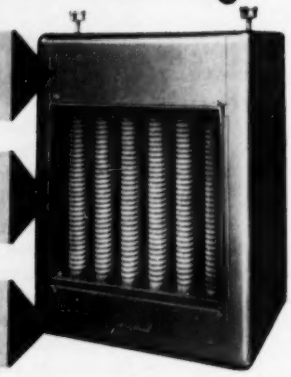
For more information on Bahnson products, clip coupon to your letterhead and mail today.

- ☐ Send information on Type E
- ☐ On all humidification equipment
- ☐ Have engineer call

Name_____

Bahnson Company
ENGINEERS AND MANUFACTURERS
WINSTON-SALEM, N. C.

...to combine
®Janitrol GAS heating
with your cooling!



APPLICABLE to same duct work used for new or existing summer air conditioning systems.

BEST method of conserving space. Janitrol blowerless Units fit right into the common duct.

COMPETITIVE because of simpler installation, lower initial and operating costs, high efficiency and long life.

Here is a proved and practical way to install heating with summer air conditioning, using common duct work.

Where space is a problem, suspended Janitrol Duct Units are the ideal solution to provide efficient and economical heating without the use of any additional floor area.

These gas-fired units are available in six sizes with A.G.A. rated input from 85,000 to 450,000 Btu/hr.

Janitrol's constant research and engineering have resulted in an ideal unit especially designed for combined systems. As an example of this, all heat exchanger tube assemblies of Janitrol Duct Units are armored inside and out with a special ceramic finish for positive protection against corrosion to assure longer life.

THREE JANITROL DUCT UNITS provide comfort during the heating season in the Birmingham, Alabama church shown below.

WRITE for specifications on Janitrol Duct Furnaces, Bulletin DF-53 and name of local Janitrol representative.

SURFACE COMBUSTION CORPORATION • TOLEDO 1, OHIO

ALSO MAKERS OF *Surface* INDUSTRIAL FURNACES
Kathabar HUMIDITY CONDITIONING

units and mechanical refrigeration systems for railroad refrigerator cars. Mr. Krans formerly was professor in charge of the Heat Power Laboratory at the University of Illinois.

The Trane Co. also has announced the appointment of *DON REED* as export manager.

FRANK P. PURVIS has been appointed to the newly created post of general sales manager and *HAROLD E. DONOVAN*, railway sales manager, of the *AIR-MAZE CORP.* Mr. Purvis has been Chicago district manager for the past seven years.

JACK S. BELDON now is manager of marketing of the Air Conditioning Div. of *GENERAL ELECTRIC CO.* Mr. Beldon, who joined General Electric early this year, has been working on special marketing assignments on consumer goods. Previously he had been a division manager with Montgomery Ward in Chicago.

WILLIAM W. QUITMEIER has been named Chicago district manager of *CONNOR ENGINEERING CORP.*, to supervise industrial and commercial sales of "Kno-Draft" air diffusers and "Dorex" activated carbon air recovery equipment. Mr. Quitmeier was formerly with the Powers Regulator Co.

G. W. SPANIOL, JR. has been named mechanical superintendent of an atomic plant construction job at Waverley, Ohio. He has been general manager of American Sheet Metal Works & Supply, Inc. Mr. Spaniol will coordinate construction activities for American Sheet Metal Works, Peter Kiewit & Sons Co. and George Koch & Sons.

Election of *JAMES M. KENNEDY* as chairman of the board and chief executive officer of *REVERE COPPER and BRASS, INC.*, and of *CHARLES A. MACFIE* as president, has been announced by the company. Mr. Kennedy, previously president, succeeds the late James J. Russell. Mr. Macfie has been vice president and general sales manager of all rolling mill sales.

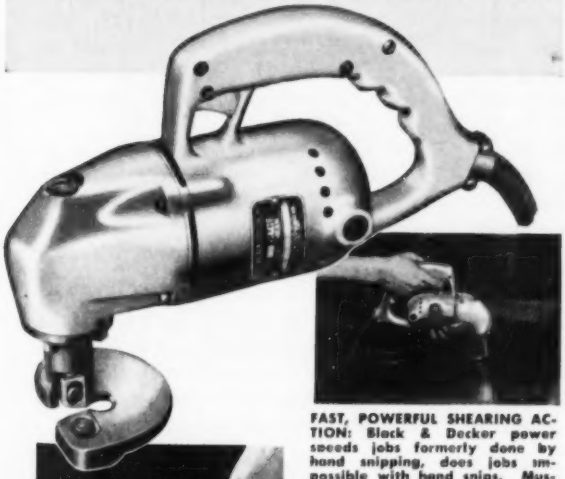
Announcement was also made of the appointment of *RAYMOND P. WINBERG* as general sales manager to succeed Mr. Macfie. A vice president of Revere since 1950, Mr. Winberg has been in charge of the Rome Div. Succeeding Mr. Winberg is *ROBERT M. LAKE*, who has been sales manager of the division.

J. L. GIBSON, an assistant chief engineer for *FRIGIDAIRE*, has been appointed chief engineer of this General Motors division. He succeeds the late S. M. Schweller. Mr. Gibson has been with Frigidaire's engineering department since 1926 and was named assistant chief engineer three years ago. *HOWARD E. VAN SCOYK* succeeds Mr. Gibson as assistant.

NEWTON H. WILLIS is the new manager of the Railway Div. of the *WAUKESHA MOTOR CO.* He succeeds Lee W. Melcher, who retired recently. Mr. Willis joined the company in 1930.

Throw away your snips!

Switch to Black & Decker Electric PORTO-SHEARS for faster, easier, more accurate cutting!*



FAST, POWERFUL SHEARING ACTION: Black & Decker power speeds jobs formerly done by hand snipping, does jobs impossible with hand snips. Muscular strain is a thing of the past!

CUTTING OPERATION ALWAYS VISIBLE: Follow straight lines, irregular patterns and curves down to small radius easily with Porto-Shears. Visible operation keeps rejects to a minimum.

CUTS MANY MATERIALS: steel, galvanized iron, Monel, stainless, copper, aluminum, lead, and other non-ferrous metals. Adaptable to thin sheets of laminated wood or sheet plastics.

Once you've used a B&D Electric Porto-Shear, you'll never want to go back to slow, tedious hand snips. B&D Porto-Shears cut sheet metal too tough for snips! They speed up jobs where snips are slow . . . save time and cut costs on hundreds of jobs. . . eliminate muscular strain. Like all B&D tools, Porto-Shears are made with husky housings, top-quality parts. Two models, in capacities for 16-gage and 12-gage steel. See your nearby Black & Decker Distributor for demonstrations of these and other famous B&D Tools. Write for free catalog to: THE BLACK & DECKER MFG. CO., 640 Pennsylvania Ave., Towson 4, Md.

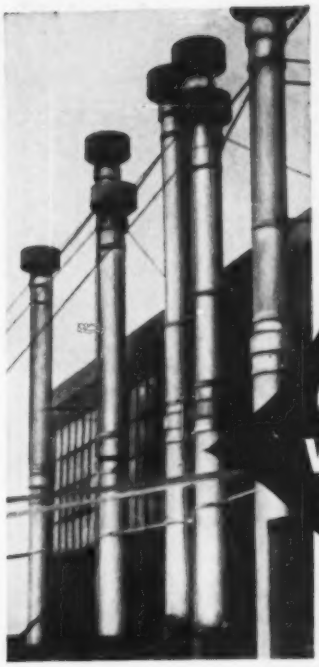
*Trade Mark Reg. U. S. Pat Off.

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

PORTABLE ELECTRIC TOOLS

DRILLS SANDERS BENCH GRINDERS HAMMERS



18 YEARS OF TOUGH VENTING HAS PROVED . . .

. . . TRANSITE* INDUSTRIAL VENT PIPE *lasts longer*

Transite Industrial Vent Pipe is known to many users for its exceptionally long service life. In lines where aggressive gases, fumes and vapors are present, it has proved itself time and time again. Maximum corrosion resistance is imparted to asbestos, cement and silica during manufacture which includes a special Johns-Manville steam curing process. Transite has paid for itself, sometimes over and over again, on many installations.

In addition, Transite Industrial Vent Pipe cannot rust. It needs no painting or other protective treatment. It has been used as ducts, vents or stacks for 15 to 20 years and longer . . . remaining in excellent condition . . . outlasting other material by a wide margin. (Transite has served the factory shown above for 18 years.)

Transite is light in weight and easy to handle. It can be cut and drilled with ordinary tools. It comes in a complete range of sizes up to 36" in diameter. A full line of corrosion-resistant Transite fittings makes it adaptable to practically any job requirement.

For further details on Transite Pipe for your venting problems, simply fill out and mail the coupon to Johns-Manville, Box 60, New York 16, N. Y. In Canada: 199 Bay Street, Toronto 1, Ontario.

*Transite is a registered Johns-Manville trade mark

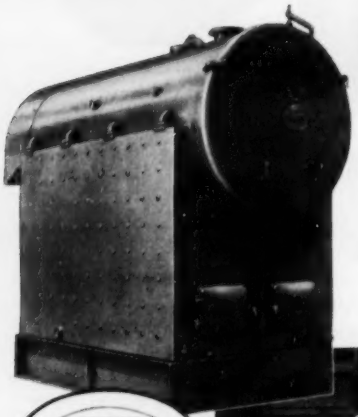
Johns-Manville
TRANSITE
Industrial Vent
PIPE

Johns-Manville
Box 60, New York 16, N. Y.
Gentlemen: For facts about longer-lasting vent pipe, please send me Data Sheet Series DS-336.
Name_____
Address_____
City_____ State_____

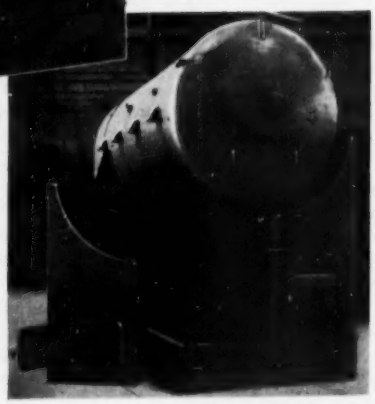
Enjoy

EASY BOILER REPLACEMENT in tough entry conditions!

TITUSVILLE *"Compact"* SPLIT FIREBOX Boilers



Left: Assembled view of Titusville "Compact" Split Firebox Boiler.



Right: The Titusville "Compact" Split Firebox Boiler with sections opened, suggesting ease of manipulation.

For replacement installations where entrance conditions are not sufficient for the standard boiler, Titusville "Compact" Steel Boilers are obtainable in split firebox design. This practical expedient permits passage of the boiler in unit sections through narrow openings, with easy reassembly. Send us your replacement problem, and let us recommend the best solution for you! Request Bulletin Form C-7959 for Clearance Dimensions.

THE TITUSVILLE IRON WORKS COMPANY

A division of Struthers Wells

Representatives in Principal Cities

TITUSVILLE, PENNSYLVANIA

DAVID W. HOPKINS, executive vice president of *R-S PRODUCTS CORP.*, a subsidiary of *S. MORGAN SMITH CO.*, has been appointed chief consultant for the Valve Div. of the Smith company, with offices in Philadelphia and York, Pa.

HARRY P. KELLY has been appointed assistant chief air conditioning engineer for the *FRESH'ND-AIRE CO.*, a division of the *CORY CORP.* Prior to his association with Fresh'nd-Aire, Mr. Kelly was a supervisor field service engineer with the White-Rodgers Electric Co.

D. C. SANFORD has been named manager of the application engineering department of the *BRISTOL CO.* Mr. Sanford joined the firm in 1937 and was promoted to Birmingham district manager in 1946. In 1948 he became an application engineer with headquarters at the company's main office in Waterbury, Conn.

The Bristol Co. also has announced the appointment of *F. W. BORCHERS* as general sales manager. Mr. Borchers has been with the company since 1922 and since 1948 has been assistant sales manager.

WILLIAM H. YECKLEY has been appointed to a new position of general manager of steel operations for the *YOUNGSTOWN SHEET and TUBE CO.* For the past three years, as assistant to the vice president in charge of operations, he has been directing steel operations in both the Youngstown and Chicago districts.

The board of directors of the *L. J. MUELLER FURNACE CO.* has announced the appointment of *E. J. OVSHAK* as secretary of the company. Mr. Ovshak has been with the firm for 17 years and has served as assistant secretary for the last 12 years. Succeeding him as assistant secretary is *ROBERT F. HUME.*

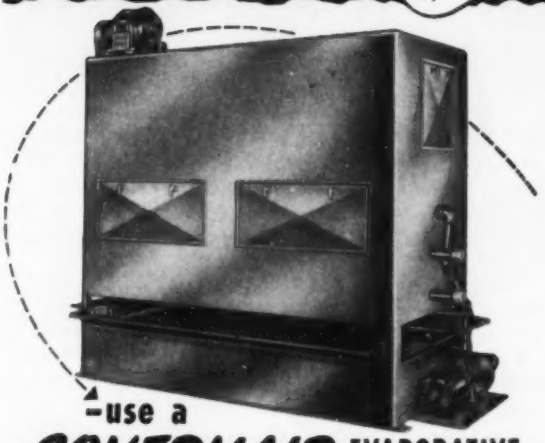
J. A. CAMERON has been appointed executive vice president and assistant general manager of the *MARLEY CO.* He has been eastern regional manager. Mr. Cameron has been a vice president of the company since 1944 and in 1952 was elected to the board of directors.

FRANK R. BENEDICT has been appointed staff engineering manager for *H. E. SEIM*, vice president and general manager of the *WESTINGHOUSE* Sturtevant Div. and Air Conditioning Div., and the *BRYANT ELECTRIC CO.*, a subsidiary of Westinghouse. In his newly created position, Mr. Benedict will oversee and assist in the direction and coordination of the engineering and development of these divisions. He has been with the company since 1928 in various engineering capacities.

W. D. SULLIVAN, assistant works manager of the *TUBULAR PRODUCTS DIV.* of the *BABCOCK & WILCOX CO.*, has been transferred to the company's Boiler Div. In his new position as regional manager of the division, he will assist in the coordination of manufacturing in the division's seven plants.

Two other appointments announced by the division are

When water is a *Headache...*



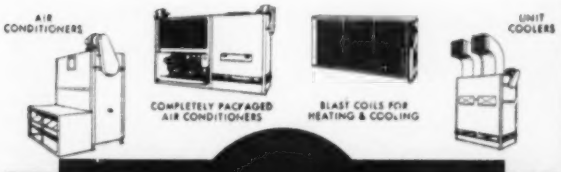
-use a **GOVERNAIR** EVAPORATIVE CONDENSER

Water supply for air conditioning *can* cause you a lot of trouble. When there's a shortage; when rates are expensive or when sewage and piping are impractical—*water becomes a real headache!*

That's when engineers and contractors alike turn to Governair Evaporative Condensers!

Governair Evaporative Condensers eliminate waste-water disposal problems and pumping costs. And they're engineered to give maximum efficiency and performance at a reasonable cost. Available in sizes from 3 to 100 tons.

Choose a Governair Evaporative Condenser and there's no need for aspirin! GOVERNAIR CORPORATION, 513 N. BLACKWELDER, OKLAHOMA CITY, OKLA.



GOVERNAIR

ORIGINATORS OF COMPLETELY PACKAGED AIR CONDITIONERS

MERCOID SENSATHERM®

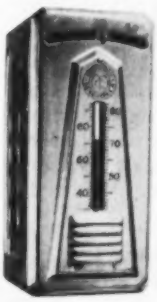
Exclusively Equipped with the Mercoid Magnetic Mercury Switch

SERVICE-FREE PERFORMANCE

Dust, dirt or corrosion cannot affect the electrical circuit of a Mercoid Sensatherm.

For over twenty years, the Mercoid magnet operated mercury switch has proven its dependability by providing millions of positive "makes" and "breaks" without deterioration.

This same type of switch is used throughout all industry where critical and faultless operation is dependent upon a positive and enduring contact.



LIFETIME FINISH

The aluminum cover with its beautiful metallic finish will last a lifetime—no warping, peeling, cracking or discoloration.

NO INTERNAL HEATERS

Internal heaters are not required in the Sensatherm. The Sensatherm maintains an even room temperature level within ½°F., plus or minus. There are no adjustments to make—no special settings—simply set it and forget it.

Write for catalog No. 700A.

THE MERCOID CORPORATION
4201 BELMONT AVE., CHICAGO 41, ILLINOIS, U.S.A.

Airlouvers

have to fit...

you order them that way

Fill any wall opening with one or more weather-tight units tailored for the need

. . . without premium cost

The conveniently wide size variation in Airlouvers — the unique Swartwout louver system for industrial and commercial buildings — virtually gives you custom-made equipment at economical standard costs. Odd-size units within certain dimension brackets make it easy to fill any size opening with multiples of uniform sections.

Construction is sturdy and efficient. Strong formed channel frame houses overlapping blades that assure weather-tightness. Adjustable style Airlouver features positive closing and quick change of blade position. Several operating methods available. Made in fixed-blade style also. Write for Bulletin ALO-F.

Swartwout Industrial Louvers

Where standard size louvers can be used, this type provides maximum free opening — up to 90%, or any proportion thereof through adjustable operation of blades. Swartwout Industrial Louvers are made in single, double or triple section units of from two to twelve blades. Ask for complete description and sizes.

50 YEARS SERVICE TO INDUSTRY — 1903 - 1953

18511 Euclid Avenue, Cleveland 12, Ohio

The Swartwout Co.

Roof Ventilators and Ventilating Louvers

POWER PLANT EQUIPMENT • PROCESS INDUSTRY CONTROLS

those of *A. B. CAPRON* as assistant works manager in charge of the tube mills and engineering, and *NEWELL HAMILTON* as manager of steel operations.

JAMES D. KEARNS has joined the staff of the Z-Crete Div. of the *ZONOLITE CO.*

LARRY COOPER is the new president of the *WINDMASTER CORP.* Well known in the heating industry, Mr. Cooper has been in the heating business for almost 30 years.

DONALD W. KENTLER has been appointed manager of credits and collections for the *GENERAL ELECTRIC CO's.* Air Conditioning Div. He replaces *FRANKLYN G. ZIMMERMAN*, who has been made a consultant in the treasury services division of the company in New York.

Appointment of three department heads and the addition of five engineers and two scientists has been announced by the *WALTER KIDDE NUCLEAR LABORATORIES, INC.* The new department heads include *DR. CECIL B. ELLIS*, Research Dept., Laboratory Div.; *J. J. BYRNES*, Engineering Dept., Laboratory Div.; and *KARL PUECHL*, Theoretical Dept., Development Div.

Staff additions to the Laboratory Div. include: *G. BARTOLOMEI, SR.*, project engineer; *D. M. BENFORADO*, junior chemical engineer; and *C. W. STANLEY*, scientist.

Staff additions to the Development Div. include: *B. J. BYRNE*, junior engineer; *S. MILLMAN*, junior scientist; *R. YANOWITZ*, junior engineer; and *M. ZIZZA*, junior engineer.

IN THE TERRITORIES . . .

For *YORK-SHIPLEY, INC.—EDWARD E. BANGS* is executive assistant in the company's gas heating division. Mr. Bangs' primary duties will be to develop distribution and sales of boilers, winter air conditioners and conversion burners in the New England territory.

For *BECKMAN & WHITNEY INC.—G. E. MOXON SALES CO.* has been appointed factory representative for northern California. The Moxon organization will handle the company's line of instruments for industrial air pollution work and scientific meteorology.

For *KRITZER RADIANT COILS, INC.*—Four additions to the staff of sales representatives are: *D. M. ARCHER CO.*, 143 Federal St., Boston, for Boston and vicinity; *C. N. RINK CO.*, 27 Rittenhouse Pl., Ardmore, Pa., for the Philadelphia area; *J. W. STEVENS CO.*, 1425 Erie Blvd., East, Syracuse, N.Y., for central New York; and *THERMAL SPECIALTIES CO.*, 11 N. 14th St., Harrisburg, Pa., for the Harrisburg area.

For *DELCO PRODUCTS DIV. of GENERAL MOTORS CORP.—JOHN E. McNEIL* has been appointed western district sales manager with headquarters in Los Angeles.

Hospital in Montgomery, Alabama, equipped with No. 5 Lo-BLAST Burner

FOR EVERY TYPE OF BUILDING

LO-BLAST

IS THE GAS HEATING "BUY"

From coast to coast, you'll find Lo-BLAST Power-type Conversion Gas Burners heating buildings ranging from small residences to entire villages heated from a central plant. Preference for Lo-BLAST springs from proved efficiency, safety, durability . . . *operating records show an average saving of* 10%!

Compare these operating and construction features:

Power Burner Design. Perfect combustion, regardless of draft—a proved fuel saver. Safe and efficient for down-draft units.

Simple to Install. Every Lo-BLAST is factory tested on gas and shipped assembled.

Safe Operation. Lo-BLAST comes equipped with dependable, foolproof safetys.

Soft, Quiet Flame. No "pop" when the Lo-BLAST goes on or off—burns so smoothly you can hardly tell it's running.

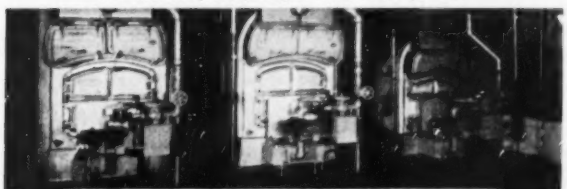
Easy to Service. All parts are accessible—nothing in the firebox but the fire. Simplicity of design and durable construction reduce service to a minimum.

Long Lasting. Many Lo-BLAST Burners have been in operation 15 years without service.

Complete Capacity Range. Units available from 70,000 to 20,000,000 BTU input.

The "mighty-mite" of conversion gas burners—capacities from 70,000 to 500,000 BTU. All the famous design features of the larger Lo-BLAST packed into a low-cost unit for residential use. Write for descriptive literature.

This battery of Lo-BLAST Burners handles 11,000 sq. ft. of steam radiation plus 10,000 gallons of hot water per day.



MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

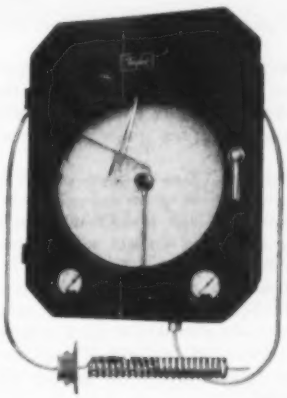
Taylor keeps you from blowing hot and cold!

Whether you use air conditioning for human comfort or for the manufacturing or storage of sensitive or perishable products . . .

Whether you need a single control instrument for an isolated application, or multiple controls for a complete system . . .

Taylor can help keep the air conditioned at the temperature you want, within very close limits.

We make a full line of accurate control instruments for practically every air conditioning need. And we'll be glad to work with you or your consulting engineers or contractors to find the answer to your individual problems. Ask your Taylor Field Engineer, or write Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.



TAYLOR FULSCOPE® TEMPERATURE CONTROLLER

No. 121RV120 is equipped with a special pre-formed capillary bulb designed for accurately measuring air temperatures. This controller precisely positions such devices as lever motors, diaphragm valves, dampers, etc., to produce the required air conditioning result. Available for on-off control, throttling control, or highly precise control; to reposition valves, lever motors or other pneumatically controlled devices.

Automatically compensates for changes in occupancy or processing loads.

Controls refrigeration compressors, automatically starting and stopping them according to the demand for artificial refrigeration.

Prepares for Summer or Winter changeover automatically by controlling fresh air and exhaust damper diaphragm valves.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

Kno-Draft recommends
Alnor VELOMETER
for Precision Air Flow Readings

Ask The W. B. Connor Engineering Corporation how to balance an installation equipped with their Kno-Draft diffusers, and they'll tell you . . . measure the *actual* air delivery—precisely and quickly—with an Alnor Velometer.

Balancing a Kno-Draft equipped installation is a fast and accurate process when using an Alnor Velometer. A few simple readings of the instrument and a twist of the wrist are all that is required to adjust the air flow to the desired amount.

The Velometer is the *only* instantaneous, direct-reading air velocity meter—accurate in all ranges, from high to low—compact, portable, easy to understand and use. Wide assortment of jets and fittings makes this precision instrument ideally suited for all air velocity measurement.

For your air measurement needs, get an Alnor Velometer. You'll save time and money wasted in balancing air distribution on your next installation. If you'd like a copy of the instructions on balancing Kno-Draft diffusers with the Alnor Velometer, just send the coupon below.

Illinois Testing Laboratories
Room 513, 420 N. LaSalle St.
Chicago 10, Ill.
☐ Send Kno-Draft Balancing Instructions
☐ Send Velometer Bulletin 2448-G

Name.....
Company.....
Address.....
City.....Zone.....State.....

Alnor PRECISION INSTRUMENTS FOR EVERY INDUSTRY

Mr. McNeil has been with Delco Products since 1942 in various engineering and sales capacities.

DE LAVAL STEAM TURBINE CO.—ARTHUR L. FOLTZ, JR., is manager of the Detroit district office. In his new post, he is in charge of sales and application in this territory of centrifugal pumps, steam turbines, centrifugal blowers and compressors. He has been with the Allis-Chalmers Mfg. Co.

For *D. J. MURRAY MFG. CO.*—New sales representative for "Grid" unit heaters and blast coils is the *JOHN HAWE CO.*, 568 N. Snelling Ave., St. Paul, Minn. The sales territory includes the states of Minnesota, and North and South Dakota.

For *FEDDERS-QUIGAN CORP.—ALLAN T. LACEY*, district sales manager, has been promoted to regional sales manager of the central region with headquarters in Chicago. He formerly was in charge of sales in Illinois, Michigan, Wisconsin, Missouri and Indiana. His new assignment will add Ohio, West Virginia, Kentucky and Tennessee to his territory.

For *SERVEL, INC.—HARRY F. HALDEMAN, INC.* of Los Angeles has been appointed air conditioning distributor in the Southern California area. The trading area covers the following counties: Imperial, San Bernardino, southern half of Los Angeles, Orange, San Diego, Riverside and Ventura.

For *CENTURY ENGINEERING CORP.—HENRY G. GABEL* is the new middle Atlantic sales manager. Mr. Gabel will make Norristown, Pa. his headquarters and will supervise sales in eastern Pennsylvania, southern New Jersey, Delaware, Maryland, northern Virginia, northeast West Virginia and Washington, D.C. For the past five years he has been district sales manager for the Electric Furnace-Man, Inc., a subsidiary of General Machine Co.

For the *SCHAIBLE CO.*—Two new western regional sales offices and warehouse facilities. The company's new west coast warehouse is located at 2444 E. Eighth St., Los Angeles. The headquarters sales office for the entire western region will be located at the Los Angeles address. A second sales office will be located at 53 Beale St., San Francisco. *ROBERT B. DAVISON* has been appointed western regional sales manager and will be responsible for operations in 11 western states.

For *MARSH HEATING EQUIPMENT CO.*—New representative in the Washington, D.C. territory is *A. W. NUGENT & CO.*, 8519 Glenview Ave., Takoma Park 12, Md.

For *RIC-WIL CO.*—New sales representative in the New York area is *JOHN F. HANBURY ASSOCIATES*, 207-215 E. 37th St.

WEINMAN

Close

Coupled

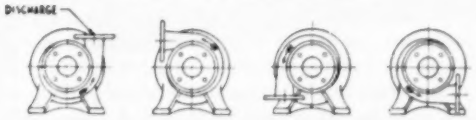
Centrifugal

Pumps

lower in first cost, lower in maintenance cost!

Installation of air conditioning systems is sometimes a tricky business. Space in existing buildings is usually limited, making pump replacement a real problem. WEINMAN close coupled centrifugal pumps are designed to lick this problem, and here's the way they do it:

WEINMAN pumps require less space to begin with. They can be mounted in any position. Note, too, that the discharge can be turned to any one of four different positions.



This means you can mount a WEINMAN pump on the wall, suspend it from the ceiling, bottom or side of a tank, or on the floor . . . important where installation space is limited.

If pumps are a problem that's plaguing your installations, call a WEINMAN Centrifugal Pump Specialist. He has the solution and the pumps, to solve the toughest jobs.

"Centrifugal Specialists"

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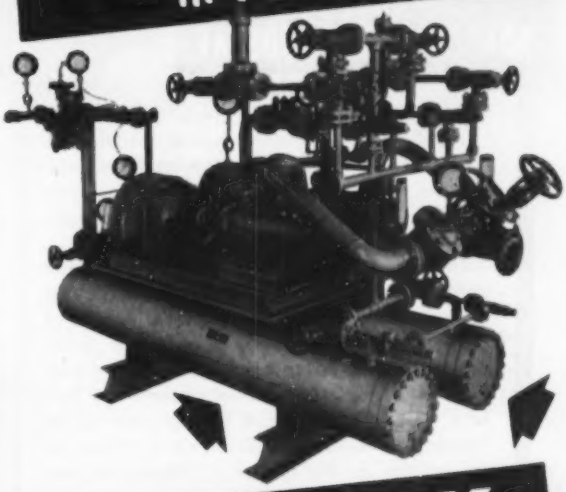

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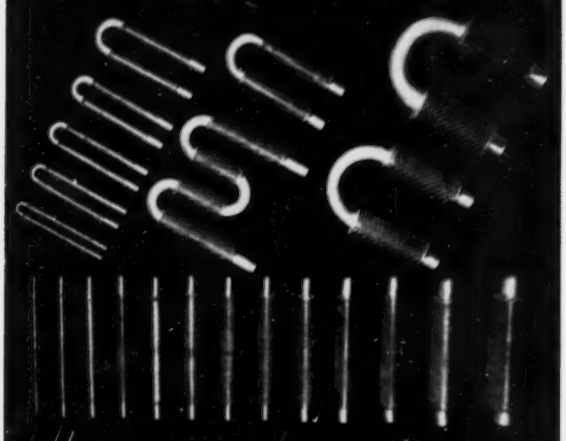

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NEW BOOKS & REPORTS . . .

Control of Heating and Air Conditioning

Automatic Control of Heating and Air Conditioning, by John E. Haines, vice president, Minneapolis-Honeywell Regulator Company, is a 350-page book, carefully prepared and illustrated, to fill a long standing need for a detailed text on air conditioning and its allied refrigeration controls. Engineers, contractors, service men and students interested in this field will find it a valuable reference book on the principles and applications of such controls. The author states that the text is intended as an elementary text book rather than an advanced treatise, and for this reason, he has kept his material straightforward, concise and uncomplicated by mathematical derivations.

The text is divided into 14 chapters covering fundamentals, definitions, control circuits, control units and the control applications. The adequate and detailed coverage in the latter field is of particular interest. There may be some small criticism of the fact that all equipment illustrations, although unidentified, are those of a single manufacturer. But, at the same time, it must be admitted that there is no stopping point if an attempt were to be made to include the details of all manufacturers. This would clutter the text and obscure the real purpose of illustrating the control *principles* involved. It is suggested, however, that consideration could be given in future revisions to including discussion and illustrations of the more unique features of some competitive designs.

The text covers in detail the control of domestic heating, from the most elementary system and hand firing, to the modern automatic systems. Considering the present emphasis on home air conditioning, it would be desirable to include in this information the specific details applicable to domestic air conditioning, including the controls for domestic heat pump applications. Heat pump applications are limited in number at present for household use and the author may consider that such information is premature and of too limited usefulness at this time.

The problems of control of commercial heating and air conditioning and commercial refrigeration are dealt with adequately for the problems normally encountered, including my old friend, the "dual-duct" system, sometimes called the "double duct" system and referred to in the text as a "hot and cold deck" system. It was surprising to note that a constant hot duct temperature (100 F) was indicated for the system. Such systems operate by mixing the air from a hot duct and a cold (tempered air) duct to maintain the required room or space temperature. In days past, the magic number for the hot duct for some unexplained reason was 130 F. A reduction in the control temperature is helpful but experience has indicated that it is impossible to accomplish proper control for these systems in moderate weather with a fixed hot air duct temperature, because damper leakage and temperature pick-up from the hot to the cold duct will cause overheating. In most installations, automatic compensating control is required to vary the control temperature of the hot duct in parallel with the outside air conditions and the consequent heating requirements. Where good operating engineers are in attendance at all times, this adjustment can be made manually.

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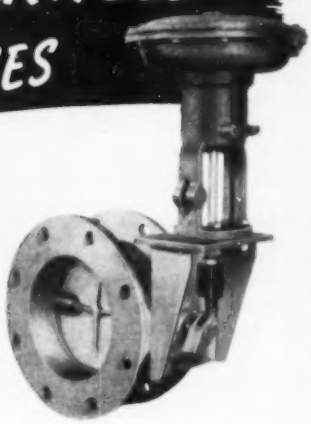

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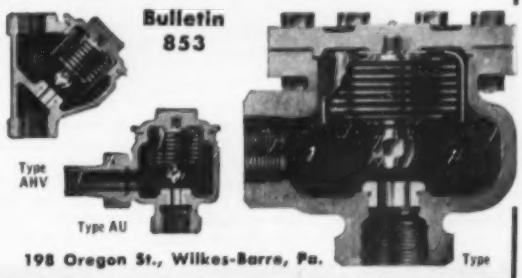

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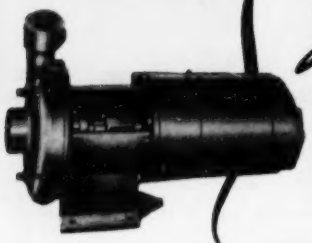

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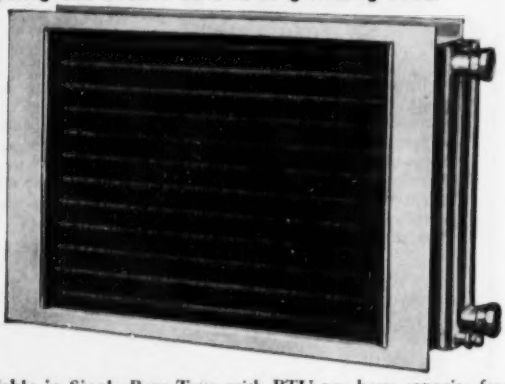

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The control of radiant panel heating is handled in a separate chapter. Because the problems are similar, there is no differentiation between the domestic and the commercial problems. This chapter is exceptionally clear and well written and would be recommended reading for any person trying to acquaint himself with the problems involved.

Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, this book is available at $6.75 a copy.—*Reviewed by John H. Clarke.*

Weld Standards

To enable the engineers of machinery manufacturers and fabricators to acquire both cost and quality control over welding operations, a new set of *Weld Standards* has been published. The standards are available on tracing paper so that they can be blueprinted or otherwise reproduced to give engineers and production personnel a standard for communicating welding procedures on drawings. The standards are based on procedures developed by the publisher, the Lincoln Electric Co., and the weld symbols of the American Welding Society.

The new standards, with a letter designation, specify according to plate thickness both the type and size of weld as well as how it should be made. For a specified plate thickness, the standards give the electrode type and size, the polarity and current, electrode melt-off rate, arc speed, number of passes or beads, feet of joint welded per hour, and the pounds of electrode required per foot of weld. Standards have been prepared for manual welding of butt welds, fillet welds, lap and corner welds in all positions in both plate and sheet metal.

Complete sets of 19 sheets on tracing paper in a loose-leaf binder are available from the Lincoln Electric Co., 22801 St. Clair Ave., Cleveland 17, for $1.00 per set in the United States and $1.50 elsewhere.

Refrigeration Manual

A completely revised edition of the *Trane Refrigeration Manual* has recently been released.

The latest edition of the manual contains two new chapters on refrigeration piping. This material embodies the latest engineering data on the subject. Other changes include a new chapter on refrigeration system control, a revised chapter on service operation and a completely revised refrigeration system service analysis chart.

The manual begins with a discussion of refrigerants and the refrigeration cycle. Succeeding chapters give detailed information concerning the selection, insallation and servicing of all the component parts of refrigeration systems, including evaporators, compressors, condensers, thermostatic expansion valves, refrigeration system control equipment, motors and motor control equipment, heat exchangers, dryers, valves, piping and accessories.

The 125-page manual can be purchased from the Trane Co., La Crosse, Wis. for $1.50.

SYMPOSIUM on CONTINUOUS ANALYSIS of INDUSTRIAL WATER and INDUSTRIAL WASTE WATER—prepared by the ASTM Committee D-19 on Industrial Water. Emphasis is on the use of automatic equipment.

Copies of this 64-page Symposium, in a heavy paper cover, can be obtained from the American Society for Testing Materials, 1916 Race St., Philadelphia 3, at $1.50.

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Monarch Brass F-80 Air Conditioning Nozzles (or 1/4" male one-piece H-261 style) produce the finest possible breakup of small capacities with low direct pressure only. No air required.

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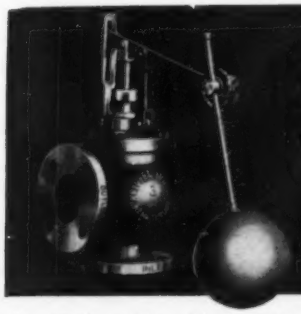

No. 77 illustrated — Single seated float valve for dead end service. Internal pilot control. 250 lbs. max. inlet pressure. Does the job of more complicated control valves at a much lower cost wherever tight closing float valves are required for make-up water control. Sizes 2" — 8". Other types. Get BULLETIN 349.

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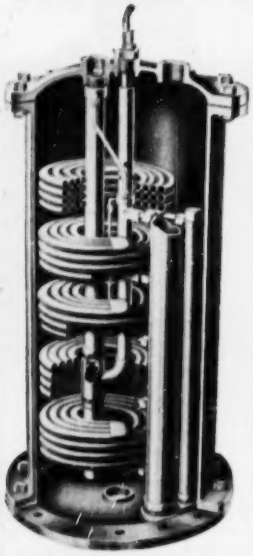

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MEETINGS & CONVENTIONS...

FIFTH INTERNATIONAL MECHANICAL ENGINEERING CONGRESS, 10 Avenue Hoche, Paris, France —To be held in Turin, Italy, October 9-15. This meeting is the fifth of a series organized by the engineering trade associations of Western Europe. Theme of this year's Congress is, "Production and Assembly Methods for Components in Mechanical Engineering."

NATIONAL ASSOCIATION OF VERTICAL TURBINE PUMP MANUFACTURERS, 301 W. Avenue 26, Los Angeles 31 — Fall meeting, October 11-12, Broadmoor Hotel, Colorado Springs, Colo.

CORROSION CONFERENCES — Sponsored by the National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2. The following meetings and conferences are scheduled: Short Course on Cathodic Protection, University of Illinois, Urbana, October 12-16; Southeast Region meeting, Birmingham, Ala., November 12; Cathodic Protection, University of California, Los Angeles, November 16-18; Western Region meeting, November 19-20, Biltmore Hotel, Los Angeles.

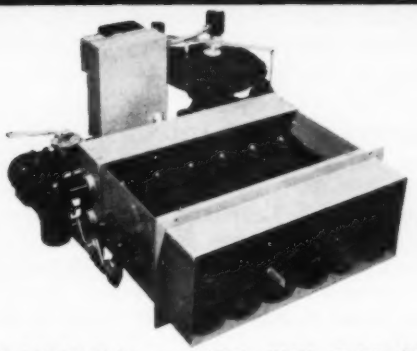
CONFERENCES ON RADIANT HEATING — Sponsored by the Dept. of Architecture, Pratt Institute, 215 Ryerson St., Brooklyn 5, N.Y. To be given on Tuesday evenings during October and November, the sessions will cover: radiant heating in contemporary architecture, October 13; design standards, October 20; engineering design and installation, October 27; controls, November 3; the builders' and owners' viewpoint, November 10; and research and development, November 17.

IBR SCHOOL OF MODERN HEATING — Fall and early winter schedule includes schools in Springfield, Mass., October 13-15; Reading, Pa., October 20-22; Charleston, W. Va., October 27-29; Canton, Ohio, November 4-6; Scranton, Pa., November 17-19; Providence, R.I., December 1-3. Tuition is $28. Those wishing further information may obtain it from the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17.

41st NATIONAL SAFETY CONGRESS AND EXPOSITION—October 19-23, Chicago. Sessions on industrial safety are scheduled for the Hilton, Congress, Morrison and Hamilton hotels. Further information is available from R. L. Forney, general secretary, National Safety Council, 425 N. Michigan Ave., Chicago 11.

NATIONAL NOISE ABATEMENT SYMPOSIUM — October 23-24, Armour Research Foundation of Illinois Institute of Technology, Chicago. The symposium, designed to give a comprehensive picture of nationwide activities in the field of noise, will feature talks by leading authorities on outdoor noise problems. One session will be devoted to the industrial noise hazard.

for Gas Firing



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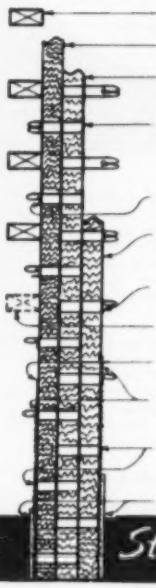

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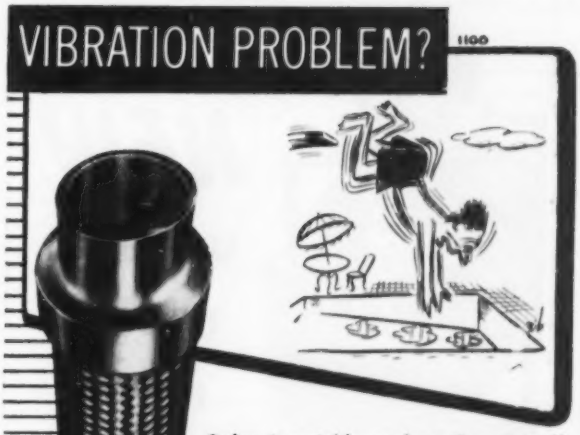

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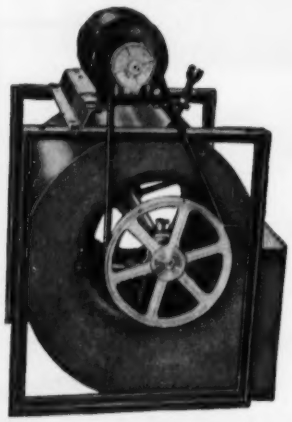

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AMERICAN GAS ASSOCIATION, 420 Lexington Ave., New York 17—35th annual convention, October 26-28, Kiel Auditorium, St. Louis. Hotel reservations are available from the Hotels Convention Bureau, American Gas Assoc., Rm. 405, 911 Locust St., St. Louis 1. Federal Power Commission activities relating to the natural gas industry and gas distributing companies, discussed by Chairman Jerome K. Kuykendall, will be one of the highlights of the convention.

REFRIGERATION AND AIR CONDITIONING CONTRACTORS ASSOCIATION, 228 N. LaSalle St., Chicago 1 — Convention, November 8-11, Carter Hotel, Cleveland.

EIGHTH ALL-INDUSTRY REFRIGERATION AND AIR CONDITIONING EXPOSITION, 1346 Connecticut Ave., N.W., Washington 6, D.C. — November 9-12, Cleveland Public Auditorium, Cleveland. Emphasis will be on marketing opportunities for retail establishments.

NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION, 145 Public Sq., Cleveland 14—40th annual convention, December 2-3, Hotel Cleveland, Cleveland. The convention will commemorate four decades of association service to the central warm air heating and air conditioning industry. Topics to be discussed include selling, new markets, new developments and latest research.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 40 W. 40th St., New York 18—49th annual meeting, December 6-9, Washington, D.C.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York 13 — Annual Meeting, January 25-27, 1954, Rice Hotel, Houston, Texas. See page 124 for further details.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 1061 M & M Bldg., Houston 2—Tenth Annual Conference and Exhibition, March 15-19, 1954, Kansas City, Mo. Co-chairmen are F. L. Whitney, Jr., Monsanto Chemical Co., St. Louis and H. L. Bilhartz, the Atlantic Refining Co., Dallas.

HEATING, PIPING AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOC., 1250 Avenue of the Americas, New York 20—65th annual convention, May 24-28, 1954, Hotel Traymore, Atlantic City, N.J. Acting secretary is Lloyd B. Gruman, Jr.

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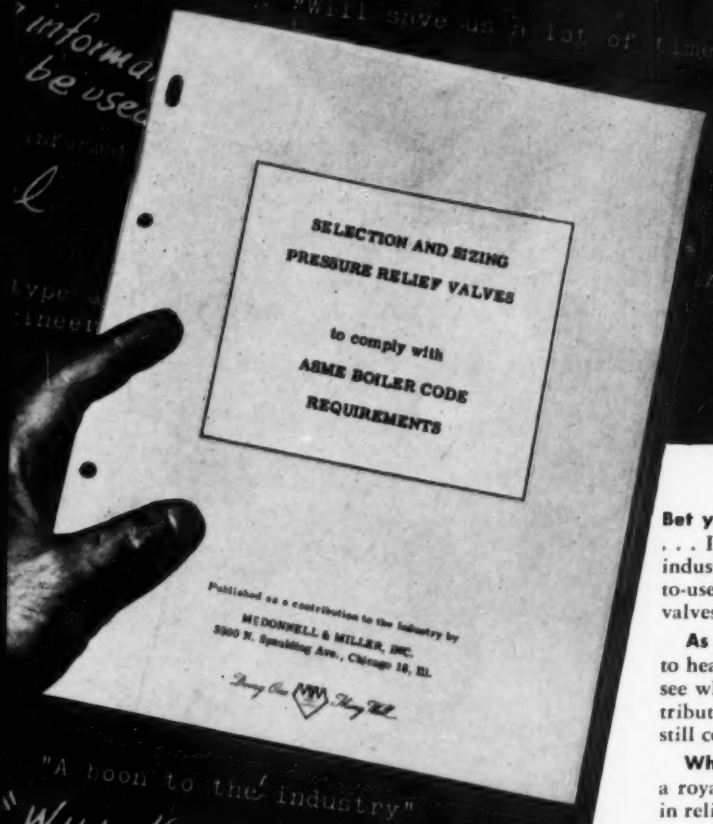
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